UNIVERSITY OF CALIFORNIA

PUBLISHED BY

THE W. J. JOHNSTON COMPANY, Limited,

Established 1874. Incorporated 1889.

168-177 POTTER BUILDING, NEW YORK.

W. J. JOHNSTON, President.

CLARENCE E. STUMP, Treas. and Business Manager.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

T. COMMERFORD MARTIN and JOS. WETZLER, M. E., Editors.

WM. A. ROSENBAUM, Editor Patent Department.

WALTER T. HUNT, Advertising Agent.

New England Office, { 8 Cook Building, cor. Congress and Franklin Streets, Boston.

W. I. BARKER, Manager.

Western Office, 44 Lakeside Building, Chicago.

E. L. POWERS, Manager.

Philadelphia Office, 31 City Trust Building.

E. F. CLARKE, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.

(Including Postage in the U. S., Canada or Mexico.)

IN CLUBS of 4 or more the rate is $2.50 a year each; with a free extra copy to the getter up of a club of 8.

Subscription to foreign countries, $5 a year.

In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED **FIFTEEN** YEARS AGO,

THE ELECTRICAL WORLD

IS THE PIONEER WEEKLY ELECTRICAL JOURNAL OF AMERICA, AND HAS WELL MAINTAINED ITS LEAD.

IT HAS THE LARGEST CIRCULATION

OF ANY ELECTRICAL PERIODICAL IN THE WORLD, AND IS

THE BEST ADVERTISING MEDIUM.

Correspondence, views and opinions on a topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

Matter for the **Editorial** Department should be addressed to

The Editor of The Electrical World, New York.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished on application covering these points.

For Sale Notices, Situations or Help Wanted, $1 to $2 an issue.

Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to

THE W. J. JOHNSTON COMPANY, Ltd.,

Potter Building, New York,

OR EITHER OF THE BRANCH OFFICES.

"THE ELECTRICIAN" IN THE UNITED STATES

AND "THE ELECTRICAL WORLD" IN THE UNITED KINGDOM.

Arrangements have been made by which the London "Electrician" can be obtained from THE ELECTRICAL WORLD *office, 168-177 Potter Building, New York.*

The rate of subscription (payable in advance), including postage, is $6 per annum to any address in the United States, Canada, Mexico or other foreign country.

Single copies, price 10 cents, can also be obtained at THE ELECTRICAL WORLD *office. Similarly* THE ELECTRICAL WORLD *can be obtained in England at the office of* The Electrician, *1 Salisbury Court, Fleet Street, London, E. C.*

The rate for English or foreign subscribers (payable in advance) £1. 1s

VOL. XIII. NEW YORK, FEB. 16, 1889. No. 7.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE.
Improved Siemens Electro-Dynamometer ... 82
Some Remarkable Experiments with Phonograph and Telephone ... 82
The Queen City Dynamo ... 83
A Novel Automatic Switch ... 83
The Silvertown Dynamo ... 84
The Factory of the C. & C. Electric Motor Company ... 85
Sprague Electric Roads at Brockton, Reading and Wilmington ... 87
Ward's Electric Omnibus ... 88
An Electric Blowpipe ... 88
The New Sperry Dynamo and Lamp ... 89
CORRESPONDENCE:
Light Without Heat. By A. B. Worth ... 84
Lead vs. Iron as Casing for Cables. (Illus.) By David Brooks ... 88
EDITORIAL:
Paragraphs ... 81
MISCELLANEOUS:
The "Benjamin Franklin" in Direct Competition with Steam ... 82
Electromotive Force of Selenium ... 83
Marking Binding Posts. By H. F. Watts ... 84
Another Rival Telegraph ... 86
On the Occlusion of Gases in the Electrolysis of Cupric Sulphate ... 87
Electrically Illuminating Steam ... 87
In Favor of the Bell and Against Wallace ... 88
Electric Lighting and Health ... 89
Telegraph Service in Canada ... 89
SPECIAL CORRESPONDENCE:
New York Notes, 90; New England Notes, 90; Philadelphia Notes, 91; Western Notes, 91; Canadian Notes, 92; English Notes ... 92
DEPARTMENTS:
The Telegraph, 92; The Telephone, 92; The Electric Light, 92; Applications of Power, 93; Personals, 93; Miscellaneous Notes, 93; Business Notices ... 94
Our Illustrated Record of Electrical Patents ... 94

Marks On Binding Posts. AN interesting little article appears in our columns this week from Mr. H. F. Watts on the eminently practical question of the intelligibility of marks on binding posts, whether on dynamos and batteries or on the lamps, motors, etc., that utilize the current from them. The subject is important, and we should like to hear from a few of our readers in regard to it. In fact, the matter might very well be taken up for discussion by the National Electric Light Association at Chicago next week.

The Day of the Electric Motor. WE consider it impossible for any one to look through the pages of our issue this week without being impressed with the fact that the electric motor is with us as a great reality, not something "read of in books or dreamt of in dreams," but the very latest and most successful appliance for the practical distribution of power. On one page is an account of notable work on the New York elevated roads. On another is a description of an electric omnibus running in the tortuous streets of London. A third page contains an illustrated article on three successful electric street railways; while two other pages tell and show how power is distributed all over a vast factory building by means of the electric motor that is itself manufactured in thousands in the establishment. Who will deny that this is the day of the electric motor?

The Coming Convention. THE convention of the National Electric Light Association that is to be held at Chicago on Feb. 19, 20 and 21 has every promise of being the most important yet held by that body. It will certainly in many ways contrast with the first meeting, held in the same city in 1885, when amid doubts and misgivings the organization was born. The record states that 91 persons registered on the secretary's book on February 25, 1885, and even that number was larger than had been expected. The programme, too, was a meagre one, and as for exhibits, they were barely worth mentioning. But the spirit of progress was there, and thanks to the men who have stood by the association from that time until now and have given value to its membership, the organization goes back to Chicago to hold a convention with hundreds in attendance, with a score of big practical topics to be disposed of and with exhibits enough to constitute a first-class electrical exposition. President Duncan may well feel proud of the body that follows his leadership, and that will face him next Tuesday.

Electricity on the Elevated. BY one of those coincidences that often become significant in after years, it happened that just at the time when passenger transportation in New York City was seriously interrupted by the great strike of the street car drivers, the electric motor "Benjamin Franklin" began to run on regular daily schedule on the Ninth Avenue elevated road as a demonstration of what it could do if employed as a substitute for the steam locomotives now in service there. An article will be found on the next page giving some interesting details and figures in regard to the performance. Mr. Leo Daft deserves credit for the manner in which he has stuck to the task he set himself in experimenting on the elevated roads, and for the persistence with which he has sought the solution of the many problems connected with the replacement of steam by electricity. Many a man would have fallen back disheartened at the magnitude of the difficulties to be overcome, and Mr. Daft has hardly received the praise that is his due for such persevering, and one must say, successful attacks on the work in question. The operation of the train as described is, we believe, a feat quite beyond parallel in electric railway work, and it is the more praiseworthy for its accomplishment in the face of the drawbacks of which our article makes brief mention.

Recording Telephonic Conversation. THERE were probably few among the audience which listened to Mr. W. J. Hammer during his lecture on "Edison and his Inventions," before the Franklin Institute, and saw his experiments on the transmission and recording of speech between New York and Philadelphia, who realized that they were highly privileged. They had witnessed what is unquestionably the first practical example of the recording of speech transmitted telephonically over an actual line wire. There were embodied in the accomplishment of this experiment three of Mr. Edison's greatest inventions, the phonograph, the carbon transmitter, and the motograph receiver, and with their combined employment what has long been sought for was accomplished, and, we may add, with complete success. To those who are acquainted with the great difficulties encountered in new experiments in the field of telephony, the smoothness and success of those just accomplished are little short of marvelous, and show all three instruments employed in them to be the product of true genius in the perfection of their working. The effect of this successful attempt can hardly be foretold. It opens up at once a wider field, not only for the telephone, but for a greatly increased application of the phonograph; for after this demonstration we need only imagine each telephone provided with a suitable phonograph, so that all conversation may be recorded if desired. Or, on the other hand, we may conceive a conversation recorded at the other end of the line during the absence of any one at the receiving end, and repeated by the phonograph upon the arrival of the person for whom the message is intended. Other applications will suggest themselves to our readers. As above stated, these experiments mark an epoch in the field of telephony and phonographic recording, and Mr. Hammer "builded better than he knew," well aware as he was of the meaning of the test he had in hand.

Belts vs. Wires. ONE of the most absorbing discussions which took place at the last electric light convention was that relating to the distribution of power, and the principal lines upon which the discussion was based had reference to the methods of distribution in large or small units, more particularly power distribution to machines situated on the same floor, and without direct reference to a more general application of power throughout a large building. Whatever may be the relative merits of the systems of distribution in which each machine is operated by an individual motor, or a series of machines are operated by one electric motor, there can be no gainsaying the fact that where several floors of a building are to be operated by one prime mover, such as a steam engine, the most economical method of distribution is accomplished by means of electric motors individually to each floor, and without the use of belting from floor to floor. This is perhaps best exemplified by the example just presented in the newly equipped factory of the C. & C. Electric Motor Company in this city. We would be lacking in our duty if we failed to call the careful attention of our readers to this decided departure in methods of power distribution. To those who have operated large factories and who know the difficulties encountered in belt transmission on a large scale, the arrangements described on another page will prove of the highest interest. More important than all is the record of power delivery by the engine during an average day's run. This shows at a glance the almost perfect regulation of power delivered to power consumed, and the high economy obtained with this method of distribution. It would, indeed, be difficult to believe that the machinery in operation could be driven by the small number of motors in actual operation, but of its practical accomplishment there can be no doubt. The C. & C. Electric Motor Company have inaugurated a system which we feel certain will become the standard one for all similar installations.

The Chicago Convention.

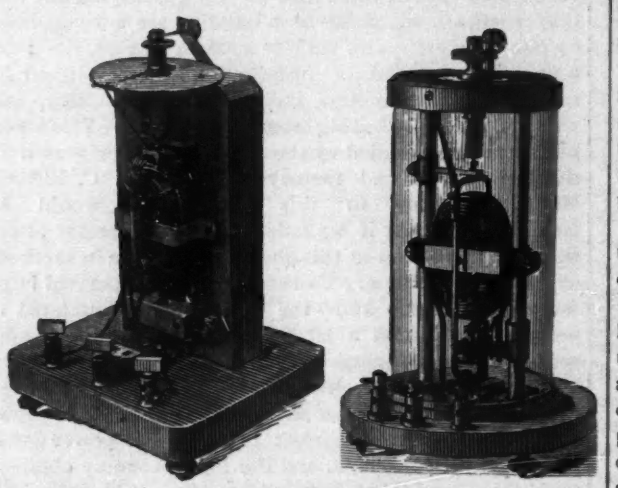
It is now announced that the special train for the Electric Light Convention at Chicago will leave at 9:30 next Sunday morning, Feb. 17, from Desbrosses and Cortlandt street ferries. Tickets will be on sale at the New York Electric Club, 17 East 22d street, this city, on Saturday evening, Feb. 16. An agent of the Pennsylvania Railroad will be at the Club to dispose of tickets to any one then requiring them for the trip from this city. Ladies accompanying delegates will be entitled to the special rates, the details of which have already been announced in our columns. With regard to Boston, it may be taken for granted that the contingent from that city will join the New York party in good time. The Philadelphia arrangements are mentioned in the letter from our regular correspondent in that city.

Mr. B. E. Sunny, Chairman of the Executive Committee of the National Electric Light Association, informs us that the final preparations for the accommodation of the exhibitors and the meeting of the National Electric Light Association are being rapidly completed, large forces of men being constantly employed for the purpose. Apparatus from exhibitors is already being received and the booths for its accommodation are nearly ready. The railroad track is 850 feet long and is all down. The track has been laid out with special reference to practical illustration of actual work, and to this end is provided with a 50-foot curve. The tickets are all ready for distribution and electric lights for the illumination of the building are being put up. Both arc and incandescent lights are used, and there will be an especially fine display of lights in the assembly room. The rostrum for the speakers has been erected, and ample seating accommodations have been prepared. The press room is next to the assembly room. It has been divided into four compartments, and the different electrical papers will be accommodated in these four divisions. The regular cloakroom of the building, which is just across the main hall from the electric light exhibition rooms, will be utilized for the accommodation of wraps, and check boys in the uniform of the local District Company will be on hand to check and take care of wraps. As every one knows who is familiar with the exposition building, the electric light exhibition rooms are in two sections. The heavy fast-running machinery will be confined to one of these sections, which the Executive Committee has named Department A, and the lighter exhibits will be shown in the other section, which has been named Department B. Every foot of space at the disposition of the Committee has been taken, and there will probably be an overflow of exhibits into the main hall, which is, of course, unheated. The railroad track is also located in the unheated space.

The Chicago members of the Executive Committee will tender a dinner to the out-of-town members of the committee and the other officials of the association at the Union League Club at 6 o'clock Monday evening, Feb. 18. We understand, too, that a meeting of the Executive Committee has been called to follow the dinner.

Improved Siemens Electro-Dynamometer.

The operation of the Siemens electro-dynamometer in its old form is familiar to all those who have had anything to do with the measurement of alternate currents. It may, however, serve to make some recent improvements more evident if we recapitulate, briefly, the method of working with instruments of this type. As is known, the deflecting action of one coil upon another suspended within it is counteracted by the torsion of a spiral spring, which at the same time forms the suspension of the movable coil. By neutralizing the deflecting action of the current upon the movable coil and keeping both coils in their original position at right angles to each other, the conditions are fulfilled under which the deflections will be proportional to the square of the current. In some forms of the electro-dynamometer the deflections are used directly without



FIGS. 1 AND 2.—OLD AND NEW SIEMENS ELECTRO-DYNAMOMETER.

bringing the coils back to their first position, which makes the instrument a little more portable and convenient, perhaps, but faulty when the deflections are large.

To make the improvements in the electro-dynamometer more conspicuous we present in Figs. 1 and 2 the old and new form side by side. All those who have worked with the old style will appreciate the glass cylinder surrounding the working parts of the instrument by which the annoying effects of air currents upon the movable coil are eliminated. Another great advantage is the adjustability of the mercury cup, supporting the movable coil for a short distance vertically, which saves considerable time in setting up the instrument. The device for arresting the movable coil is also very simple and effective. These adjustments were missing in the old form, or else were made in such an awkward manner as to be of very little real service. The saving of time to be gained by the use of this new form is considerable and is accompanied by an increase of accuracy. The general appearance of the instrument, which has recently been imported by Messrs. Queen & Co., of Philadelphia, is extremely neat and the mechanical details of construction are very perfect.

The "Benjamin Franklin" in Direct Competition with Steam.

Since Jan. 28 last, with the exception of two days, when the multiplication of elevated trains caused by the strike on the street railways interfered, the Daft electric locomotor "Franklin" has been running with the steam locomotives, and same number of cars, from 11 A. M., to 2 P. M., between the Fourteenth and Fiftieth street stations of the Ninth Avenue Elevated Railway.

The restriction to these hours has been solely due to the necessity of switching the locomotor to the front of the train at both termini, and this operation, while readily accomplished in three minutes, would, in "commission hours," when the headway of the steam trains is nominally three minutes, and frequently less, delay the schedule service which it is the boast of the "Franklin" never to have interfered with in the many hundred miles it has run on the Ninth avenue lines.

The tests for tractive capacity and speed, which had been varied and many from the latter part of last November up to the beginning of the present schedule service, were eminently satisfactory in all respects and unattended by the slightest mishap, delay or disappointment. They were an unbroken success from beginning to end and though noticed before in these columns, it is not out of place to refer to the more salient instances among them.

With eight empty cars in train, making a load of 122 tons, a speed of 7½ miles an hour was obtained up a gradient of nearly two per cent. without the slightest noticeable strain upon the locomotor, although the development of horse-power exceeded 120. With a four-car train, the standard for the Ninth avenue line, carrying an average load of passengers, 15½ miles an hour were easily made up the same gradient, an excess of 2½ miles over the running time of the steam trains between stations.

The "Franklin" has on several occasions attained a speed of 30 miles per hour, and it is a thoroughly safe statement to make that in its present stage 35 miles per hour may be considered the ultimate.

While these special tests indubitably established all—and more—than was looked for, there yet remained a quality that only regular and continuous service for some length of time would fully demonstrate, and which may, for want of a recognized term, be styled reliability, a word essentially American, and rather sniffed at by lexicographers, but one for which there is no complete synonym in the language. To be "on deck" in the thousand and one unforeseen and unforeseeable emergencies that occur in the practical use of machinery of any kind; to show a minimum liability to accident or derangement; a not unreasonable wear and tear and a permanency of adjustment are qualities before which abstract economy must often give way. It is needless to say that the "Franklin" ranks high on all these counts.

There has been no noticeable sparking or flashing at the brushes, either of conductor or commutator, which have for themselves shown a surprising and unexpected uniformity of contact and endurance. Under the heaviest work it has been subjected to, *no* journal has ever heated, neither field nor armature has been perceptibly warmer, and everything unmistakably indicates that in all respects the "Franklin" possesses a large factor of safety, and so far has not approached in any direction the limit of its powers.

It may be noticed that, in the present schedule work, the electric train does not stop at stations to pick up and drop passengers, and the omission, not unnaturally, may excite some curiosity. The primary reason is that the locomotor, at present, is not supplied with means of utilizing the air brakes. Though the designs are completed and will soon be carried out, the necessary reduction of speed in approaching stations with limited brake-power would so increase the duration of the trip as to dangerously encroach upon the interval available for switching. Even now the occasional inevitable irregularity of the steam trains so trenches upon the time needed for this operation as to now and then interrupt the succession of the "Franklin's" trips, and the essential uniformity demanded by the experiment would be impossible, except at the risk of further impeding the delayed steam train, which it is particularly desired to avoid. Direct trips give the electric train ample time for switching without getting in the way of anything.

The economy in the application of power is peculiarly marked in this regular running. Indicator diagrams of the driving steam-engine are taken with the train in motion by a mechanical expert, and the weight of the train being known and its speed carefully noted between stations, as well as the instant of passing them, a very close comparison of the power developed by the steam engine and that utilized on the track becomes possible. The results are not yet ready for publication, but will be shortly made known in full detail. The economical principles on which electric propulsion bases its claim to recognition can hardly be as yet a generally familiar one, and a brief outline of it is not out of place. It lies in the fact of the unavoidable wastefulness of small—especially locomotive—steam engines, and the remarkable economy of large stationary compound condensing engines of modern type. The latter will readily give a h. p. hour for 2 pounds of coal, while the best trustworthy quoted results of passenger steam locomotives is not less than 9 pounds of coal per h. p. hour. Now, while one-third of the original power, in a circuit of ordinary length, may be lost in its conversion into current by the dynamo-generator and reconversion to power by the electric motor, and in overcoming the resistance of conductor and electromotive mechanism it still is true that in the case of electrical transmission a horse-power on the track costs but three pounds of coal as opposed to nine of the steam locomotive. There are also other reasons hinging upon the interaction of currents on a circuit including several motors which tend distinctly to economy of operation.

The theory of compensation between electric locomotors working upon the same circuit was advanced several years ago by Werner Siemens, who declared, without qualification, that two electro-motors, influenced by the same current and running upon the same track, one upon an ascending and the other upon a descending gradient, are as literally and practically connected with each other as if tied together by an actual rope.

The consequence of which is that all the electric locomotors on the same circuit may be regarded as running upon a level track. The armature of the descending motor, revolving under the influence of gravity, changes its function to that of dynamo-generator and restores current to the line which is available for the motor on the ascending gradients. A most interesting illustration of this theory has lately appeared in prolonged and elaborate investigations of the distribution of power on the Seashore Electric Railway of Asbury Park, N. J., equipped and run on the Daft system.

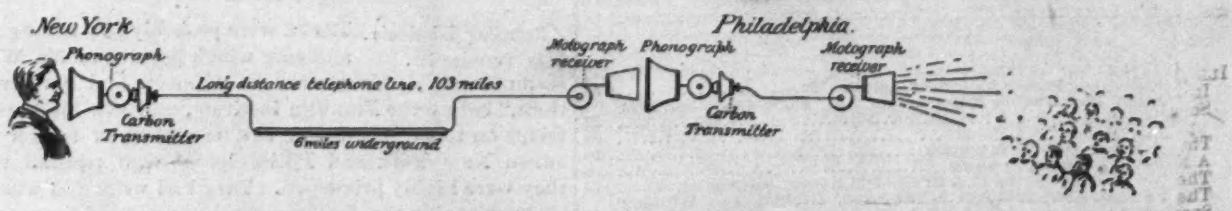
After accurately measuring the total power developed by the steam engines that drive the dynamo generators, and apportioning it, by familiar methods, among engine friction, that of the countershaft of the dynamo generator and conductive system—both mechanical and electrical—there remained 26.6 h. p. assignable to 14 cars in operation. A complete record had been kept of the number of passengers per car, which averaged 28, exclusive of driver and conductor. The speed, exclusive of stoppages, had been deduced by averaging an infinity of observations, and the number of trips was a matter of record, as was also the weight of the car. It only remained to calculate from the total weight of a loaded car—using a standard coefficient of traction—moving at the average speed, and assuming it to be running upon a level track, the horse-power equivalent to such work, and it proved to be 1.957. Dividing the total horse-power cited above—26.6—and arrived at by an opposite process, by the number of cars—14—in operation, it will appear that each car was consuming 1.9 horse-power. A more striking confirmation of the compensating influence of gravity could not be imagined than these almost identical results reached by perfectly distinct and dissimilar methods. The most insignificant gradient could not be mounted except by a greater expenditure of power than that quoted, and the only solution is that acceleration on descending gradients balanced the retardation on the ascending, and that all cars were practically working on a dead level. The fact has an important bearing on the dimensions of power station equipments, which need only be proportioned to dispose of the average work of the motors multiplied by their number, but it does not in the slightest degree modify the necessity of every electro-motor being competent for the maximum work that can ever come upon it.

What the effect of this demonstrated principle would be if applied to the 270 steam locomotives of the New York elevated railways, 90 of which stand in reserve burning a certain quantity of fuel uselessly—that is to say, in a present sense—it is surely superfluous to expatiate upon; but when applied to the thrifty electric locomotor the vista it opens is so fair and flattering as to raise suspicion with sober-sided railway financiers and managers that it is more of a mirage than an actual prospect, and heads are shaken dubiously at it. But it is no mirage, and whoever starts first for it will hold the oasis for his own.

Some Remarkable Experiments with Phonograph and Telephone.

On the evening of Feb. 4, Mr. William J. Hammer, the well known expert, delivered a lecture on "Edison and His Inventions" before the Franklin Institute, Philadelphia. This remarkably able lecture was replete with interest, and described in sequence all of Mr. Edison's inventions in the field of telegraphy, telephony, phonography, electric lighting, etc., all of which were made clear by a wealth of illustrations and experiments.

Perhaps the most striking experiments shown were those in connection with the telephone and phonograph, and consisting in the recording and transmitting of telephone conversation, music, etc. The first experiment undertaken was the recording on a phonograph in Philadelphia of music and talking transmitted over the long distance telephone line from New York, and reproducing the same to the audience.



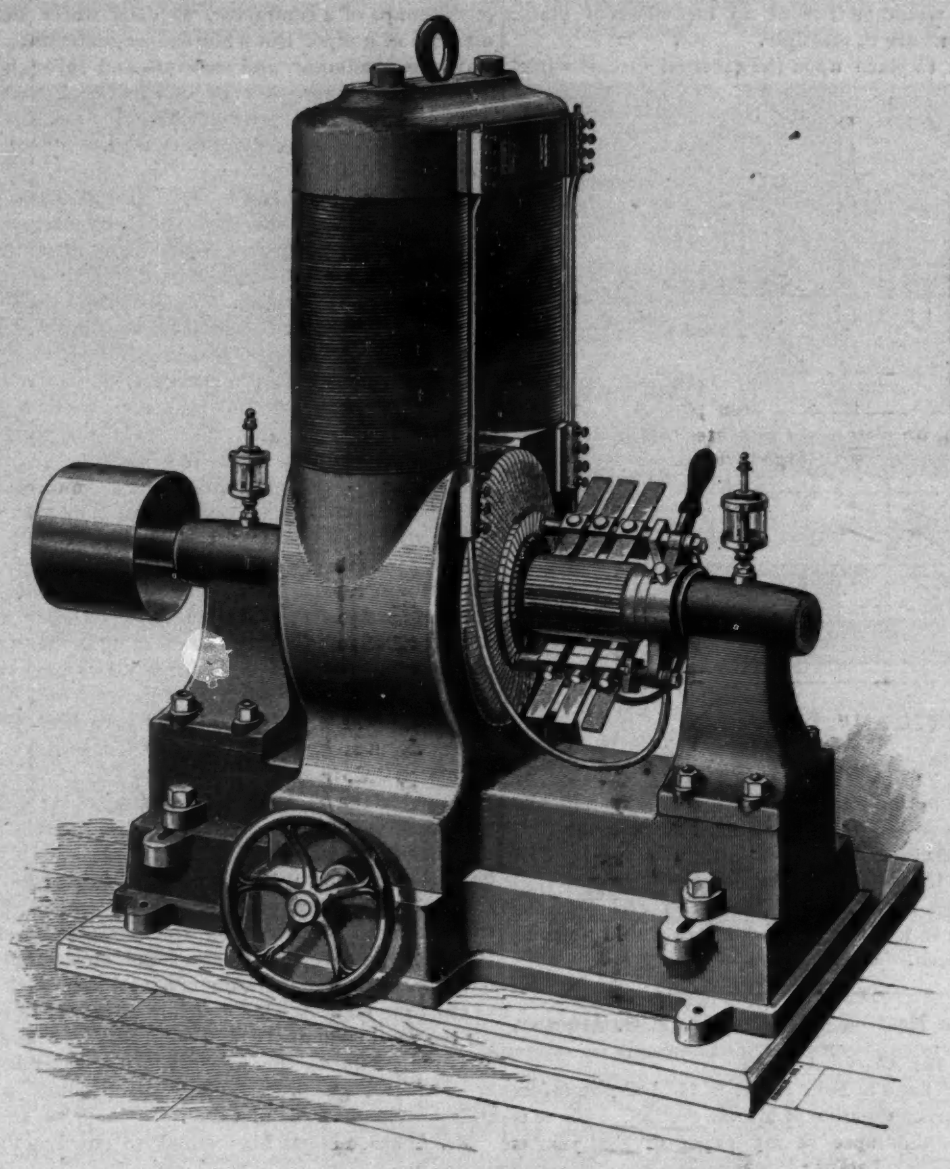
A REMARKABLE EXPERIMENT IN PHONOGRAPHIC AND TELEPHONIC TRANSMISSION BETWEEN NEW YORK AND PHILADELPHIA.

Another experiment consisted in recording music and talking upon the Philadelphia phonograph which had been talked into the long distance telephone by a phonograph in New York.

The most important test was that which is illustrated diagramatically in the accompanying sketch. This consisted in reproducing to the audience by means of the Edison motograph receiver or loud speaking telephone and the Edison carbon transmitter, the music and talking registered on the Philadelphia phonograph and which had been sent over the Long Distance Telephone line from New York (a distance of 103 miles) by the New York phonograph talking into a carbon transmitter. This wonderful experiment, as will be seen, employed two phonographs, two carbon transmitters and two motograph receivers acting in juxtapostion with 103 miles of telephone wire, 6 miles of which was underground.

The Queen City Dynamo.

Our readers will remember that in our description of the electrical exhibits at the Cincinnati Centennial Exhibition held during the past year, mention was made of the large number of lights run from the dynamos of the



THE QUEEN CITY INCANDESCENT LIGHT DYNAMO.

Queen City Electric Company of Cincinnati. At the close of the exhibition this company was awarded the first prize, a gold medal, for its exhibit, although the entries were very numerous, and competition was hot.

There were two 500-light dynamos employed, carrying 1,016 lights, driven by two Ball engines; the indicator cards on many occasions (now in our hands) show over 12½ 16 c. p. lamps per horse-power. The automatic regulation of the machine was such that even the largest changes in the load caused no difference in the brilliancy of the lamps, the potential remaining practically constant. The machine is shunt wound, and has 144 turns of wire on the armature. The standard 500-light machine illustrated is 69 inches high, occupies a floor space of 35 by 54 inches, and has a weight of 3,619 pounds.

The Queen City Company also manufacture motors of the same general type as their dynamos, and have already placed a number of them which are now running in Cincinnati—among others one in a printing office, where between opposite strokes of the printing press the current varies from 7 to 16 ampères, the motor thus constantly accommodating itself to the varying power required to drive the press, even during a single revolution.

A Novel Automatic Switch.

In starting an electric motor from rest to work certain precautions have to be taken to prevent injury to the motor due to a heavy rush of current before the armature has acquired sufficient speed to generate the proper counter E. M. F. Hence the motor must be started gradually and the current regulated until the normal speed of the armature is reached.

In order to accomplish the proper starting of motors automatically, the Automatic Switch Company, of Baltimore, Md., have recently designed a switch actuated by a single movement of a lever, which in conjunction with others sets the motor to work with safety.

The switch which is illustrated in the accompanying engraving is composed of three levers, numbered 1, 2 and 3, No. 1 being provided with a handle. The middle one, No. 2, is the circuit closer, and the bottom one, No. 3, carries the contacts over the resistance plate, at the top of the box. The handle, No. 1, has a movement of a trifle over 90 degrees, and its movement beyond the centre point necessarily gives a quick motion to lever No. 2 by means of the spring connecting them.

No. 2 carries a double-pole circuit-closing device, which enters the spring contacts in the left-hand side of the box. This same lever has on its under side a lug which stands in the path, and prevents any forward movement of lever No. 3. The circular weight in the right-hand corner of the box is a continuation of lever No. 2, and is a counterbalance to the weight of the dash pot connected with No. 3.

The movement of No. 3 is one of the novel points of the switch, it being actuated and governed by the dash pot, which is attached to a right-angled continuation of this lever. The dash pot is filled with oil or other suitable liquid, and the plunger contains a valve which allows the dash pot to be moved with perfect freedom in an upward direction, but prevents it descending rapidly by compelling the oil to pass around the plunger. The speed of its descent can, of course, be regulated by the size of the plunger. The end of the plunger rod is firmly connected with the back of the box. The upper end of lever No. 3 has contact rollers, which carry the current to the different graduations of resistance connected with the plate at the top of the box.

The action of the switch is very simple. By moving the handle No. 1 to the left, the spring connecting it with No. 2 is carried over the centre, and throws No. 2 into the three contacts, which represent the two line wires, and one motor terminal.

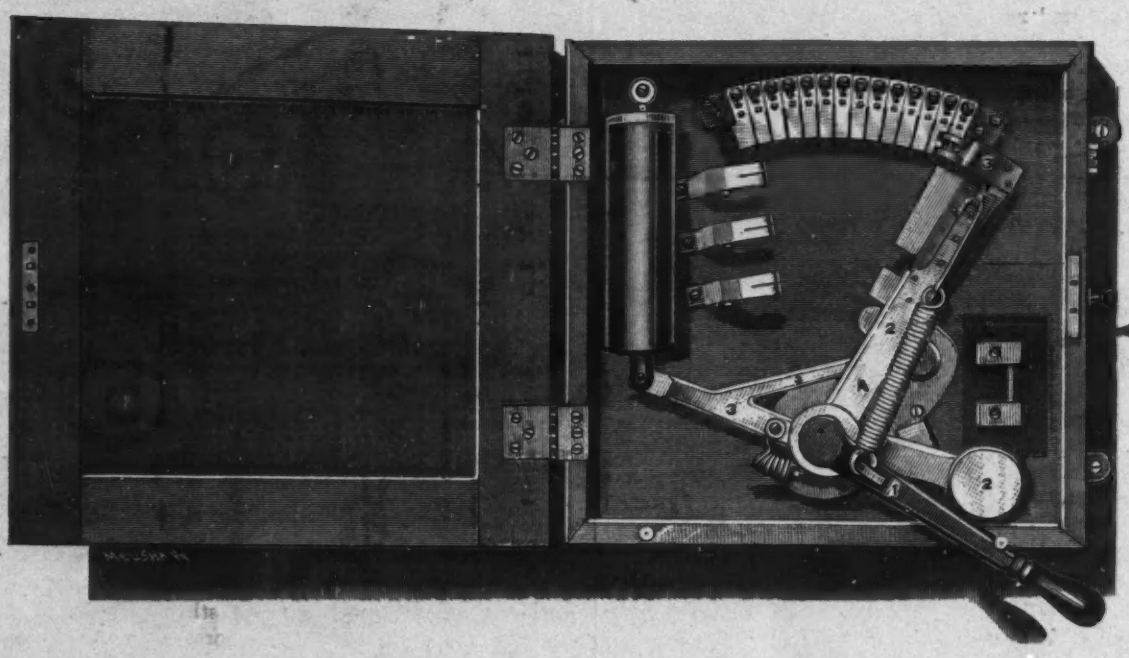
The upper knife edge on No. 2 is insulated from the lever and simply closes the line wire with the field and armature terminal of the motor, which is connected to the middle contact spring. The lower knife edge is in direct connection with the iron of No. 2, and consequently through the bearing with No. 3: but to make sure of this contact, a small coil of flexible copper cable connects both. The other field terminal is connected directly to the iron which forms the base of the switch.

The current to the armature passes out at lever No. 3, through the resistance in the back of the box, to the other armature terminal. As No. 2 has been thrown over into the line contacts, No. 3 is at liberty to be moved over the resistance contacts by the dash pot, thus gradually removing the resistance between the armature and the line.

When shutting the motor down, the handle is returned to the right-hand side of the box; its spring draws back No. 2, and with it No. 3 by means of the lug on the under side of No. 2, and thus leaves the switch in its original position. The fuse clamps on the right of the box are under the counterbalance of lever No. 2 when the switch is in use, so that if the fuse melts, no one can replace the fuse without first putting the switch in the off position. It can easily be seen that it is absolutely impossible to shut down a motor without throwing the resistance of the box in series with the armature. Therefore, there is no danger of a short circuit through the armature. Roller contacts have been used, because of the heavy pressure that can be placed on them without hindering the free movement of the lever actuating them.

As these switches are now being constructed, the dash-pot removes the resistance in about ten seconds; but if the motor is on very heavy work it can be arranged to move more slowly. Oil is here employed in preference to glycerine in the dash pot, as it never becomes sticky, and because of its ability to withstand cold; coal oil is used where there is any danger of a low temperature.

From the description it will be evident that the switch is adapted not only to stationary motor work, where it is operated by hand, but that it is specially useful in automatic work, such as in pumping, elevator running and the like, where the motor is frequently stopped and started by automatic arrangements.



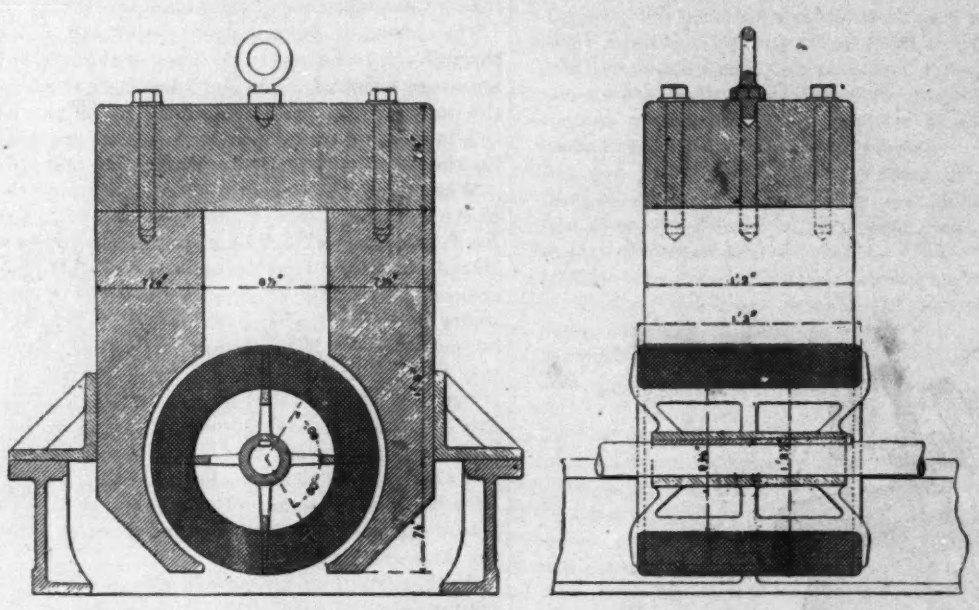
A NEW AUTOMATIC HEAVY CURRENT SWITCH.

Electromotive Force of Selenium.

In the journal of the Chemical Society the following abstract is given of a paper by S. Kalischer (Ann. Phys. Chem. [2], 35, 397–399). The author points out that the method described in Von Uljanin's paper (Abstr., 1888, 883) of preparing selenium sensitive to the production of E. M. F. by the action of light had been described by him two years ago (Abstr., 1887, 693). He states that in the paper by Fritts, quoted by Von Uljanin as well as by himself, there is no question of an E. M. F. caused by the exposure of selenium to light, as he had already pointed out. Righi, in a recent paper, states that he has obtained a current from a selenium cell in the dark, and suggests that the reason that other observers have not noticed this is that they have attributed the whole E. M. F. to the action of light. Kalischer states that he tried to obtain an effect of this kind, but without result, and he says that it does not appear from Righi's description that daylight was totally excluded in his experiments. He points out, moreover, that the method of observation of the effect of light would preclude any interference from such an effect if it existed, and that the E. M. F.'s observed are therefore entirely due to light, and not the resultants of these and of effects of the kind which Righi states that he has obtained.

The Silvertown Dynamo.

The dynamo which we illustrate in the accompanying engravings, taken from *Industries*, is of special interest as having been built to satisfy the English Admiralty requirements with regard to heating. The machine is of the ordinary Gramme type, with inverted single horseshoe magnet, as shown in Figs. 2 and 3, and manufactured by the India Rubber, Gutta Percha and Telegraph Works Company, Limited. The machine shown in Fig. 1 is intended for belt driving; but it will be easily understood that by replacing the pulley by a coupling and prolonging the bed plate, the machine can be directly coupled to a Willans engine, and it is this combination which has been supplied to the Admiralty. The armature core consists of naked iron wire of 31 mils diameter, supported on a metal spider. The core is wound on a special lathe, in which the wire is guided by an adjustable feed motion, so that the different convolutions are placed close together with perfect regularity. During the process of winding the intervening spaces between the arms of the spider are filled up with quadrant-shaped blocks, in order that the core may be perfectly circular. The armature conductor is wound by hand, and consists of 160 turns of 19 strand No. 16 cable, which is shaped on the outside into a rectangular, or rather trapezoidal section, so as to completely fill the available space. The commutator has 80 sections, and the resistance of the armature when cold is .018 ohm. The magnets are of soft annealed wrought iron, 100 square inches in section, and the bore of the pole pieces is $16\frac{9}{16}$ inches in the middle and $16\frac{1}{2}$ inches at the corners. The shunt winding is placed nearest the core, and consists of twenty layers of 83 mils wire, each layer containing 74 turns. The total number of turns of shunt wire on both limbs is 2,960, and the resistance cold is 18.6 ohms, and after six hours' run 20.7 ohms. The exciting power of the shunt winding is 11,400 ampère turns. The series winding consists of copper strip $\frac{3}{4}$ inch by $\frac{1}{4}$ inch wide, wide, there being fourteen turns on each limb. The resistance of the series coils is .006 ohm, and the exciting power 5,712 ampère turns. This gives a total exciting power of 17,112 ampère turns. The machine is intended for an output of 200 ampères at 80 volts terminal pressure when running at 460 revolutions per minute.



FIGS. 2 AND 3.—SECTIONAL VIEW OF "SILVERTOWN" DYNAMO.

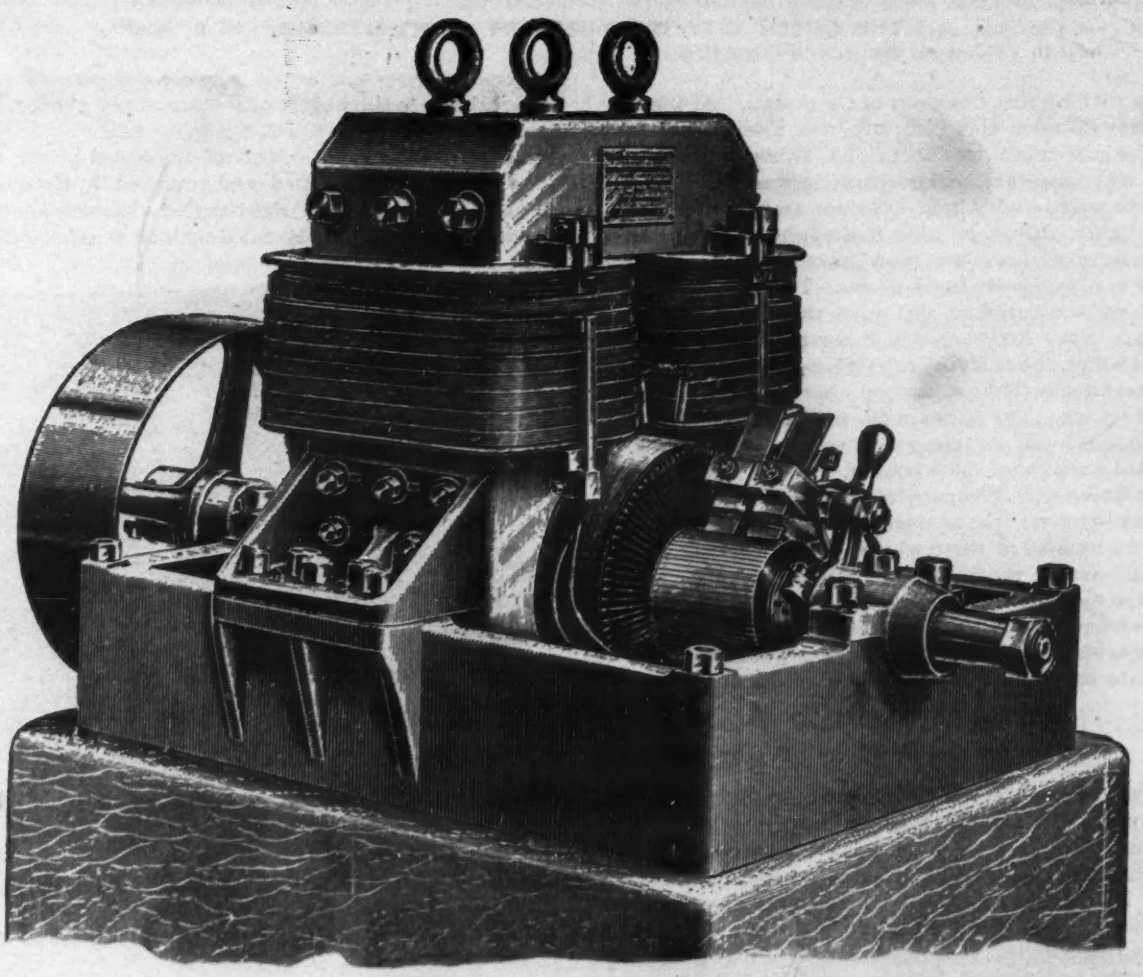


FIG. 1.—THE "SILVERTOWN" DYNAMO.

Marking Binding Posts.

BY H. FRANKLIN WATTS.

Much annoyance is often caused, and many mistakes are made, by the indiscriminate use of the terms "positive" and "negative" as applied to the terminals of dynamos, motors, lamps, etc.

These terms are anomalous, wild, and worse than useless, and should be forever blotted from the list of electric nomenclature, and replaced by terms appropriate and self-expressive, and which have no tendency to deceive persons unfamiliar with such matters.

The part of a dynamo from which current emanates is marked +, or positive, while the part through which it returns to the machine is marked —, or negative. The opposite is true of a lamp circuit; hence to connect the former with the latter, + must be connected with + and — with —.

If two dynamos are to be connected in series, + must be attached to — and — to +.

Thus we see that a rule applied to the first case is not applicable to the second, and *vice versa*.

For these and other reasons it is very desirable to employ only such marks as cannot be easily confounded and which are correct for all conditions of arc lighting, or where "everything is in series."

The letters "C" and "G" might be used as abbreviations for "come" and "go," but as one can be easily mistaken for the other, it is better to obtain greater simplicity. It is therefore suggested that the words "in" and "out" be adopted and used, and the terminals of all lamps (arc), circuits, dynamos, motors, etc., be plainly stamped "I" or "O," according to the direction of the current.

It would then make no difference whether any device is to produce or receive current. The marks on its binding-posts will clearly show how it should be connected, and the rule "connect I to O and O to I" would apply to all conditions of constant current work in the station or out.

The opposite would be true of an incandescent plant, as all connections are in multiple.

It is also well to place upon the external circuit wires, at convenient points, small galvanized tags, having stamped thereon the initials of the company and the number of the circuit, together with a large arrow, which indicates the direction of the current. The tags are of course fastened to the line wire by two small wires so that they cannot turn round. The chances of error on the part of linemen in the hanging of lamps would thus be materially reduced.

Light Without Heat—A Reply to Mr. E. G. Acheson.

To the Editor of The Electrical World:

SIR: In your issue of Feb. 2, Mr. E. G. Acheson refers to an article bearing the date of March 25, 1887. There is probably a mistake here, as my paper of that year is dated March 26, and contains no article or notice upon Mr. Acheson's work. The one no doubt meant is that of Feb. 25, 1888. But as reference has been made to the article, I feel it right to make one or two comments on the same before coming directly to the subject in hand.

One of the first statements there appearing is as follows: "A line of magnetic force must be a closed circuit, and its existence is apparently independent of the medium in which it exists. It does certainly react upon the medium, but its existence is not dependent on the existence of the medium."

Now, this statement may be an oversight, but, as written, it clearly implies that Mr. Acheson believes electricity to be of a material nature, and that it can exist independent of a medium, thus classing him with the adherents of Sir Isaac Newton's, or emission, theory. We can easily imagine a material line of magnetic force as passing through, and more or less independent of, a medium in the shape of a conductor, as does water through the medium of a pipe. But when the magnetic lines attempt to leave the conductor, and pass into and through a vacuum they must of necessity be of a material nature, as lines consisting of the mere vibrational impulses of matter cannot pass through an empty space but must have a conductor.

Mr. Acheson in his last letter in THE ELECTRICAL WORLD of Feb. 2 claims that the later experiments and researches of Dr. Hertz and others have demonstrated the accuracy of his views in regard to the theory of electricity, heat, light, etc., as set forth in the article, and which in his letter is stated to be that the modes of motion of electricity and heat are similar. But the ideas in the above quotation from the article, and which I suppose form a part of the theory, are in direct opposition to those of Dr. Hertz, whose experiments were made to prove the absolute necessity of a medium for the propagation of electro-magnetic impulses and lines of force, and that these impulses traveled at about the same velocity as do those of heat and light, and through the same medium, namely, the ether. Also that their motions are the same, but differ as regards wave length. Now, omit the quotation, and suppose the remainder of the theory as set forth in the article to be the same as that of Dr. Hertz, it would still not be new, as the same views have been held, although not proved, for a good many years.

It had, perhaps, better be stated here that these views of Dr. Hertz and others differ, so far as some of the details are concerned, from my own.

Dropping the above part of the subject we will now consider the most important part, that is, the relation of the calelectric generator to my own work. My original letter, on account of its shortness, I suppose, was considerably misunderstood. It was not intended to assume that the ideas expressed in the paragraph referring to Prof. Brackett were at present the ones employed; but only that they were drawn out and described on paper at the time mentioned. They are probably impracticable for the reasons stated below, and this was understood at the time. But as the apparatus was intended for two other special purposes besides the production of light, they were considered of value.

Mr. Acheson states his method to consist in the action of an alternating current on heat introduced into the circuit, whereby it is converted into electric currents. In my arrangement a continuous and steady current is used, but instead of acting on light or heat to any great extent, it is itself acted on by these, whereby it is broken into waves of short periods corresponding to those of light. The object here is not to convert the light by superposition into electric energy, as apparatus for this purpose has been frequently designed during the last few years, commencing in 1884. This explanation could be made much clearer were it expedient to do so. Now, it is this 1884 current, cut up into waves equaling in length

those of light, that is more or less impractical, for the reason that such a current, so cut up, is for all practical purposes light itself, and would have a corresponding effect on the ether within and surrounding the wire. And supposing that the current could be made to flow, the entire circuit would glow with various colors, according to the substances of which it was constructed. There would thus be a waste of energy all along the line, ex-

FIG. 1.—ENGINE ROOM, C. & C. ELECTRIC MOTOR FACTORY.

cepting in the included lamps. My present method consists in the use, in some cases, of an ordinary source of electricity, and in others of a special source, from which the current is transmitted to the consumer, and is there acted on by special apparatus, for the production of different forms of energy. Other arrangements are also employed. In any case, whenever used, I claim exclusively light or heat in a plane, circular or elliptically polarized condition.

Mr. Acheson has the following to say with reference to my letter: (1) "In this letter the production of light from polarized light introduced into an electric circuit, and acted upon by oscillating or alternating electric currents is mentioned: (2) It is self-evident that some other source of energy than light must be used, from which the required energy is drawn; and (3) it is more than probable Mr. Worth is utilizing the heat waves produced by chemical action as the source of his light waves. The character of the energy remains, however, the same, the rates of vibrations being their distinguishing feature." Also (4), that the patent issued to Mr. Acheson "on the production of electric currents from heat energy, by causing the heat to enter an electric conductor and therein acting upon it by changing lines of magnetic force, will fully cover the production of electric energy, even up to such rapidity of oscillations as have been found necessary for light waves."

I am obliged to deny most of the above, for the reasons that: 1. I do not generally use an oscillating current, but a continuous one, and this does not act on the impinging light, or heat, but just the reverse occurs. 2. Mr. Acheson says it is self-evident that some other form of energy than light must be used. This is true so far as the arrangements invented and patented by him are concerned, but it is not true with respect to the several forms of apparatus designed by myself, and which, being new, are patentable, and not subject to the claims of Mr. Acheson. 4. As the patent law limits a patent strictly to what it is capable, without changes made in its parts or in the substances used; and as Mr. Acheson's apparatus in its patented shape is incapable of utilizing light energy, it does not interfere with the patentability of my own invention. 3. In some cases heat is used, but generally these rays are filtered out by passing the light through solutions and by other means, according to my early work.

The following is a summary of a number of the different methods used by myself, and in one or two cases claimed exclusively. A considerable amount of apparatus has been designed under the different numbers, but none of this, I believe, in any vital way resembling Mr. Acheson's inventions, bears a date later than March 1888. The very earliest was commenced in the fall of 1883.

1. The combination of a specially formed circuit with a continuous current, and heat, or light, applied to said circuit. 2. A circuit, an intermittent current, instead of an alternating one, and heat, or light. This is perhaps a patentable variation of Mr. Acheson's apparatus. 3. Arrangement of heat or light, with a conductor, and constant magnetic field. 4. Light or heat, etc., applied to the proper sensitive substance, and with or without magnetic field or current. 5. Electricity generated by combustion and other chemical methods. 6. By the application of heat, etc., to dissimilar substances in a manner similar to the thermopile, and by heating different parts of the same substances. 7. Improved continuous and alternating current dynamos. 8, 9, 10. Three methods which, either on account of their newness, or improvements upon those now in use, it is not expedient to mention.

This does not exhaust the list, and I have work upon an equally large scale in other departments of science. Combinations of Dr. Hertz's apparatus with my own have lately been designed. The method of heating and then cooling a piece of iron whereby currents are generated, as in the Edison pyro-magnetic generator was recognized by myself early in 1885, but on account of a change of residence, and for other reasons, it was overlooked, and remained to my regret dormant, and was not developed. On reading over a few lines upon the Edison motor in 1887, the remembrance of the method was brought back with a flash. The exact theory of the working of this generator is not generally understood as well as it might be.

It would perhaps be well to mention here several forms of talking machines, or phonographs, which have been designed by the writer. These are, I think, a scientific success, but as yet not commercially so. They will work, but are made of too many parts, and require too much attention when in use, to suit the business public. Some of the early forms were placed on paper in 1886. It is the intention to sooner or later bring out an apparatus suitable for parlor use.

A. B. WORTH.

GREENPORT, L. I.

The Factory of the C. & C. Electric Motor Company.

One of the most enjoyable as well as instructive meetings held by the New York Electrical Society was that which took place on the evening of Feb. 6, when the society visited the factory of the C. & C. Electric Motor Company, situated at 402 and 404 Greenwich street, this city, on the invitation of the company. The society had as their guests the American Institute of Electrical Engineers and, together, over 150 of the members availed themselves of the courtesy of the company.

In welcoming the visitors, Mr. Harvey L. Lufkin, of the company, referred to the perfect satisfaction which the power arrangements adopted in the building had given, and added the following interesting remarks:

"Our average load on the dynamo, which is a 50,000 watt machine of 220 volts E. M. F., is about 40 ampères, or about 12 electrical horse-power, which covers both light and power. The friction load on the engine is 6.4 h. p., giving us a total of about 20 to 22 h. p. in the engine. The power which would be required to operate our factory in the usual way, by belting through the floors, was estimated by several engineers competent in factory construction to be between 30 and 50 h. p., without considering the power required for our lights, amounting to an additional 15 h. p. In other words, we are delivering an estimated 50 to 70 h. p., and only developing from 15 to 30 h. p., with an average of but 17 to 18 h. p. for 10 hours.

"Every machine in our factory bears exactly this relation to the engine. Multiply, if you please, the ½ h. p. hour saved in this machine (supposing it to be stopped for 15 minutes each hour) by, say, 50 machines running under the same average conditions, some requiring more and some less power, and you have a total of 12½ h. p. hours saved each hour, or 125 h. p. hours per day. Add this 12½ h. p. to the 18 h.p., our average load, and we begin to approach the estimated load of our factory under former conditions of practice. To this we should add about 12 or 15 h. p., which would be necessary to drive a line of heavy main belting through the six stories of this building, and we have a gross result of from 42 to 45 h. p. We have wired up in the building a total of 220 lights—212 16 candle-power, four 20 candle-power, two of 32 candle-power, and two 100 candle-power. From 15 to 25 of these lights are used all day. About 150 to 175 more are used about three hours during the day.

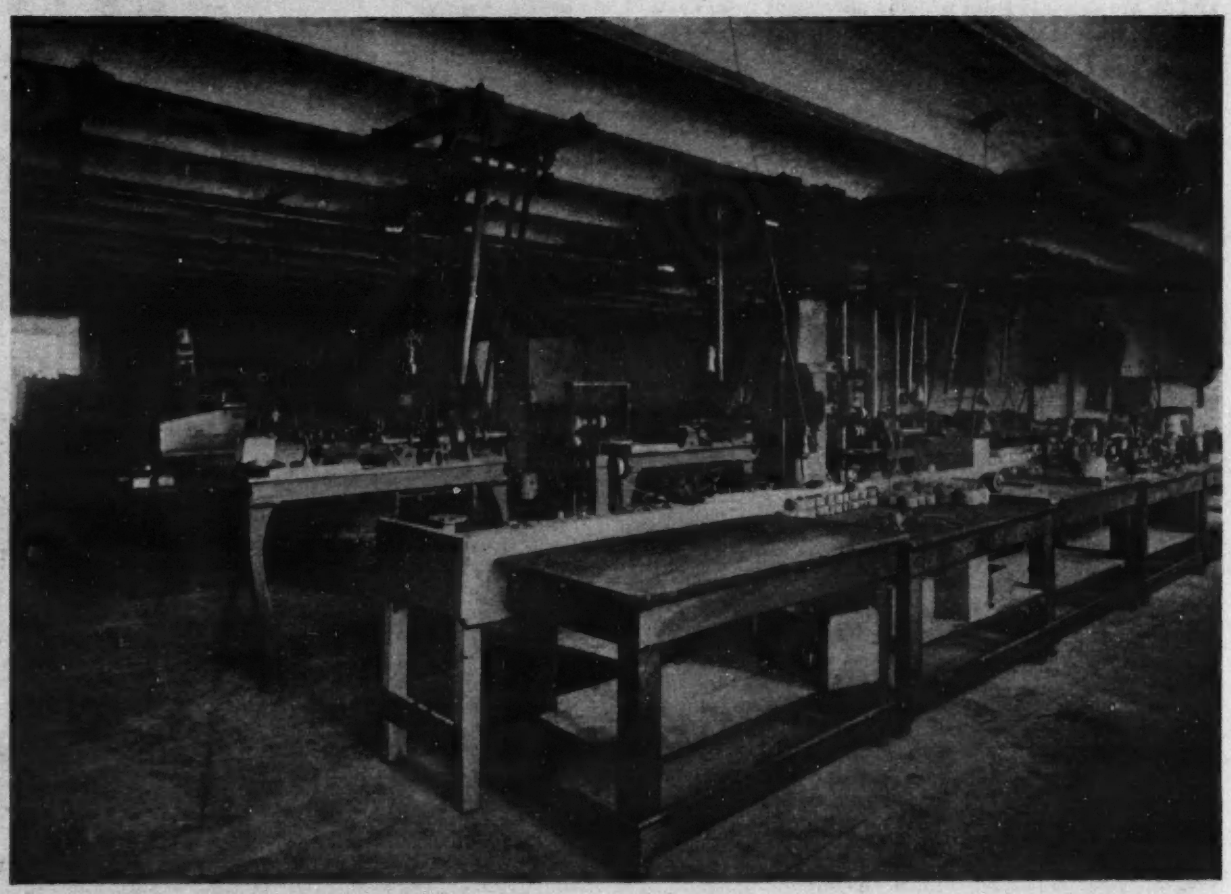


FIG. 2.—PORTION OF C. & C. ELECTRIC MOTOR FACTORY.

"Whence comes this apparent something from nothing? I will try and explain to you. Every operator in our factory who has charge of a machine, be it a milling machine or drill press, a lathe or planer, has a certain and absolute direct and instantaneous control over the automatic valve gear on our engine in the basement, through the medium of the belt-shifter on his machine. We will suppose he is using a milling machine; the piece being milled has finished its travel and the machine is stopped by shifting the belt on to a loose pulley. A horse power of duty has been taken off of the electric motor driving

that machine; the tension on the motor belt relaxes to exactly that extent; the counter E. M. F. in the armature of the motor instantly increases and the horse-power of current, which is no longer called for in the motor, the dynamo in the engine room ceases to generate, and the automatic valve gear on the engine immediately adjusts itself to a shorter cut off.

"Another great feature in this method of factory construction is the independence of each department. A break down in one or a stoppage from any cause has no effect on the other departments. Each floor is connected directly to the engine room."

The factory of the C. & C. Company deserves consideration on more than one ground. In the first place it is a model, so far as the building itself is concerned. It is a six-story structure, constructed entirely of iron and stone, having a front of 50 feet and a depth of 90 feet. The floors are all drained to the centre of the side walls of the building to sewer connections, so that the floors may be washed down with a hose or flooded in case of a fire on any floor without injuring any other floor. The hose connections on each floor connect to a 15,000 gallon brick tank placed on the roof and supplied from an artesian well under the building. An hydraulic elevator is operated from the water supplied by the tank, the piston cylinder being placed in the well from which the water is drawn to supply the tank. The visitor in passing through the factory is at once struck by the absence of belting passing through the floors, and it is in this arrangement of independent power for each floor, and, in fact, for each line of shafting, that the C. & C. Company has made a decided departure in the equipment of their works.

Starting with the engine room, which is illustrated in the engraving, Fig. 1, we find a 12 × 12 Ball engine, belted direct to a 50,000 watt Edison compound-wound 220-volt dynamo. A second driving-wheel on the engine is belted to a counter-shaft, from which is driven a 110-volt dynamo and an arc dynamo from which a current of from 6½ to 20 ampères may be obtained by suitable adjustment of the regulator. The 220-volt machine furnishes light to the building, which is wired for 220 lights, and also generates the current for driving the motors connected with the shafting.

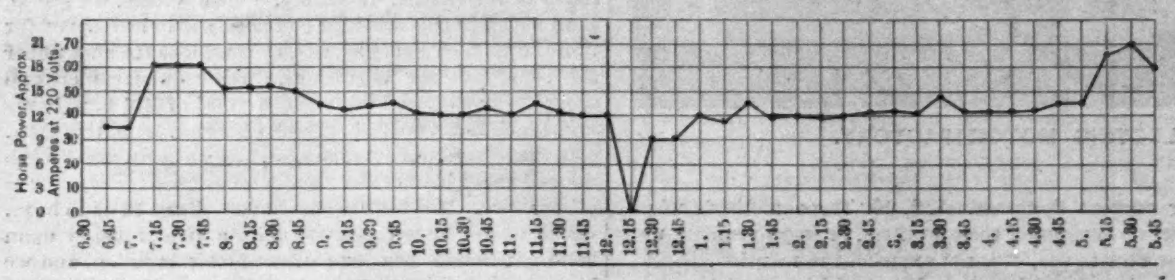


FIG. 4.—DIAGRAM OF CURRENT DELIVERY.

As above remarked, belting from floor to floor is entirely obviated, and in its place we find the wires running up from the basement from one floor to the other and connected directly with the motors. A conduit is built into the walls of the building in which the conductors lie. The first floor occupied in the manufacture of the motors is illustrated in Fig. 2 of our illustrations. On this floor most of the armature parts are built and the winding is done, and the entire department, containing some twenty machines, is operated by two motors, one of 1 h. p. and another of 1½ h. p. Both of these are suspended directly under the ceiling, and thus leave the floor entirely free from obstruction by belts. On this floor also is situated the testing room and draughting department in charge of the electrician, Mr. L. W. Serrell, Jr., who has devised a number of novel devices for the rapid testing of machines. Among these is a switch-board, by which any number of changes can be quickly made. On the floor above this, illustrated in Fig. 3, the heavier machine work is done, and for that purpose some 30 machines or more are employed, among them lathes, planers, drill presses, milling machines and a large boring mill. This department is run by four motors connected to separate lines of shafting; two of these are of 3½ h. p., and two of 1 h. p. each.

To one looking at the shop in operation it seems hardly credible that machines of such small power should be capable of doing the work which is actually accomplished, but when we consider the fact that each machine individually is in operation only for a short time, even in the busiest times of work, the sum total of the power consumed at any one time is but a fraction of that required to drive all the machines simultaneously. If to this we add the fact that the usual belting to shafting from floor to floor is done away with, it will be readily understood that the indicated load on the engine is claimed to be 50 per cent. less than would be required to operate the factory in the usual way as estimated by expert engineers in factory construction.

This is graphically illustrated in the diagram, Fig. 4, which gives the ampères delivered by the dynamo during the whole run of the factory for one day, the diagram shown being one selected from a number which did not differ materially in outline, so that an average run is there illustrated. As will be seen, the electrical horse-power delivered by the dynamo even with the heaviest load, due in great measure to the current furnished to the incandescent lamps, never exceeded 18 h. p., and at times of the day when little light was in demand, such as between 10 and 3 o'clock, the load averaged no more than 12 h. p. This showing is certainly a significant one and speaks for itself.

The accompanying illustration, Fig. 5, shows the improved form of motor now manufactured by the company. The motor is wound for 110 volt constant potential circuits, and is started by simply turning on the switch fastened to the front of the yoke and stopped by turning it back again. The mechanical construction of these motors is as perfect as the best machinery and the most skilled workmen can produce, the machine being interchangeable in every part. Every hole in each part of the machine is drilled in a standard jig; even in the large bed-plate every hole is drilled while the casting is clamped in a large jig, making it impossible for the workman to get a hole an hundredth of an inch out of the way. The pedestals carrying the bronze journal boxes also have every hole drilled in a jig; their upper surface is grooved and finished ready to receive the cap holding the journal boxes in place, with one cut in a milling machine. All the caps are milled with another standard set of cutters, making it impossible for any difference to occur in any of them. Even the parts of the rocker-arm carrying the brushes are milled with standard cutters, making them all exactly the same. The field magnets and yokes are finished in a similar manner, so that when the machines are assembled it is only necessary to take each piece indiscriminately out of a pile of finished parts and bolt them together.

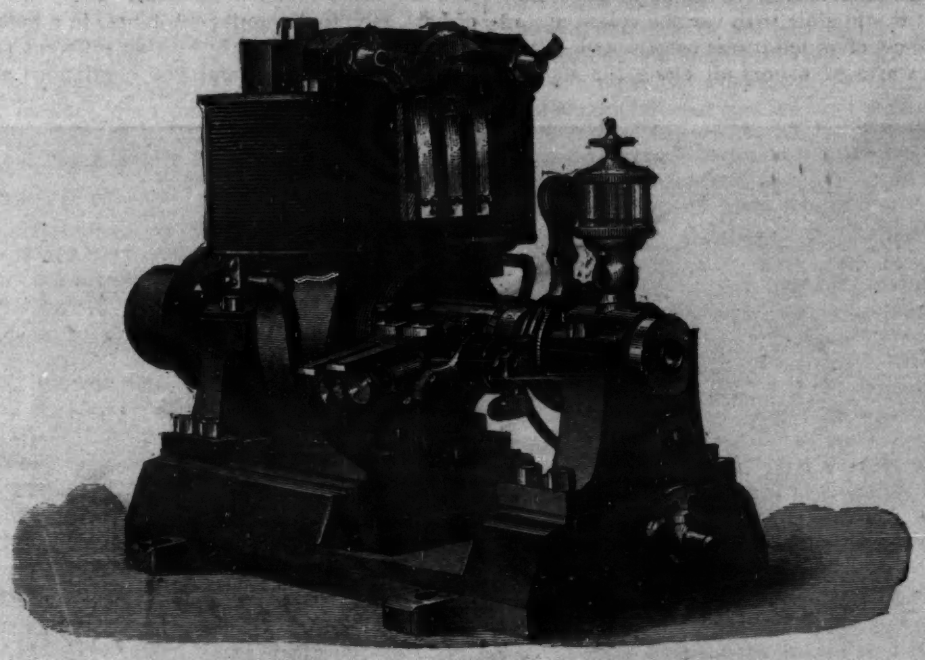


FIG. 5.—NEW TYPE OF C. & C. MOTOR.

The building and shops were thoroughly inspected by the visitors, and a hearty vote of thanks was accorded the company by the members, who all expressed their delight at the progress shown.

FIG. 3.—PORTION OF C. & C. ELECTRIC MOTOR FACTORY.

Another Rival Telegraph.

A new telegraph line has been completed from this city to Boston by the Empire and Bay State Telegraph Company. Construction work was finished about a fortnight ago, having occupied about two years. The route runs through Hartford, New Haven and Providence. It is not likely that the line will be opened for business at present, for the directors prefer to test it by experiments until all that is claimed for it shall be satisfactorily developed. It is to be operated by a multiplex system.

The most important announcement in connection with the line is that it is a bona fide enterprise and has entered the field as an honest and sturdy competitor to the present monopoly, by which it will not be absorbed.

Sprague Electric Roads at Brockton, Reading and Wilmington.

The first of the illustrations on this page is a view on the East Side Electric Railway of Brockton, Mass., of which Albert F. Small is president. This road, built and equipped by the Sprague Company, extends over a circuit of about four miles in length, operating four cars. The cut, Fig. 1, represents a test which was recently made upon the railroad, and was taken from a photograph made upon the spot. The test consisted of bunching all the cars of the company at a point on the road farthest distant from the power house, and in starting them all up at once. Although the power for all the cars was transmitted between two and three miles, the cars started up promptly, moving rapidly and showing that the entire power can be easily transmitted and applied even at the farthest end of the line, and that the load upon the dynamos can be varied from zero to a maximum without any resulting detriment to the electrical apparatus.

This electric road at Brockton has been in operation now for about four months, and it is giving very good satisfaction to both the directors of the road and the citizens of Brockton. The company do not own their own power station, but hire electricity from the local lighting company.

The second road illustrated in Fig. 2 is the East Reading Railway, of Reading, Pa. This view gives a very good idea of the method of overhead wiring for a turn-out. The road is a single-track road, extending over about two miles, and is giving good results to the president and directors of the company. The road has been in operation about two months.

Fig. 3 is a view of an electric car on the Wilmington City Railway, which has been in operation upon the Sprague system for about eight months. This road has given such great satisfaction that the directors of the road have ordered an additional number of cars. In a letter to the Sprague Company the president of the road, Mr. William Canby, says: "From the practical experience we pronounce your system a complete success. We consider it by all odds the most economical mode of running street cars in suburban districts, or in any place where permission to erect poles can be obtained. In comparison with horse power we find it decidedly cheaper and more efficient in every way. It is popular with our patrons on account of its cleanliness, its smooth and rapid motion, and especially for the absence of the usually overtasked and laboring horse."

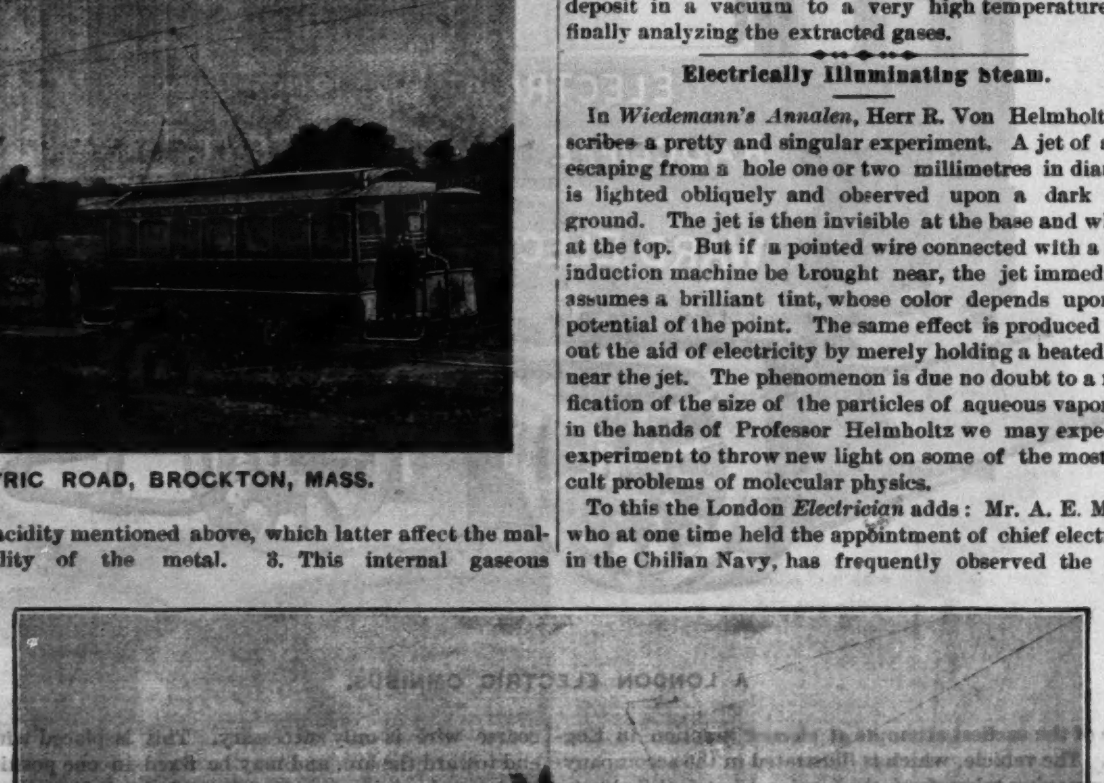


FIG. 2.—SPRAGUE ELECTRIC ROAD, EAST READING, PA.

FIG. 1.—"BUNCHING" CARS ON ELECTRIC ROAD, BROCKTON, MASS.

On the Occlusion of Gases in the Electrolysis of Cupric Sulphate.

M. Soret communicated the following observations to the Académie des Sciences, at their meeting of Nov. 5, 1888. It is a well-known fact that by electrolytical decomposition of very dilute solutions of cupric sulphate, a spongy deposit is generally obtained of dark brown or even black color, which, as stated by Poggendorff, contains a certain quantity of cupric hydride. But in sufficiently concentrated, or even saturated, solutions (and this is the case for industrial purposes, *i. e.* electro-plating), these deposits are no longer spongy but brilliant, distinctly metallic, and no cupric hydride is formed, except in cases where the electrode is of very small dimensions. The deposit is, however, *more or less malleable*, and its degree of malleability, and consequently its commercial value, depend, as is well-known, upon the *temperature* and *acidity* of the electrolyte. On the other hand, Lenz (*Journal fuer praktische Chemie*, t. CVIII., p. 436) has recognized the presence of gases, especially of hydrogen, in the electrically deposited copper, and gives the proportion of 4.4 volumes of gases as the result of an analysis of a very brittle deposit.

M. Soret's investigations have led him to the following conclusions: 1. The electrolytic copper always contains a certain quantity of gas, consisting almost exclusively of hydrogen. This retains a small quantity of carbon dioxide, and sometimes, though rarely, of carbon monoxide. 2. There exists a certain relation between the quantities of occluded gases and the conditions of temperature and acidity mentioned above, which latter affect the malleability of the metal. 3. This internal gaseous atmosphere is therefore variable, and the figure of 4.4 volumes given by Lenz can only refer to a single case observed by him. This figure corresponds to a very brittle deposit, even after having been strongly heated, and is one of the highest figures observed by M. Soret in a large number of experiments. In no case was the hydrogen in combination; it is merely a question of occlusion pure and simple. M. Soret proposes to continue these researches by performing the electrolysis of concentrated solutions containing variable quantities of free acid, and maintained at a constant temperature during the whole experiments, subsequently exposing the deposit in a vacuum to a very high temperature, and finally analyzing the extracted gases.

FIG. 3.—ELECTRIC ROAD AT WILMINGTON DEL.

Electrically Illuminating Steam.

In *Wiedemann's Annalen*, Herr R. Von Helmholtz describes a pretty and singular experiment. A jet of steam escaping from a hole one or two millimetres in diameter is lighted obliquely and observed upon a dark background. The jet is then invisible at the base and whitish at the top. But if a pointed wire connected with a static induction machine be brought near, the jet immediately assumes a brilliant tint, whose color depends upon the potential of the point. The same effect is produced without the aid of electricity by merely holding a heated body near the jet. The phenomenon is due no doubt to a modification of the size of the particles of aqueous vapor, and in the hands of Professor Helmholtz we may expect the experiment to throw new light on some of the most difficult problems of molecular physics.

To this the London *Electrician* adds: Mr. A. E. Mavor, who at one time held the appointment of chief electrician in the Chilian Navy, has frequently observed the effect described when a beam of electric light has been thrown upon a cloud of steam. For naval purposes this plan of blowing off steam and projecting the beam upon the cloud forms a most efficient method of signaling, and in action it is much better than any device involving the suspension of lamps from the yard arm, since it does not reveal the exact position of the ship to the enemy.

In Favor of the Bell and Against Wallace.

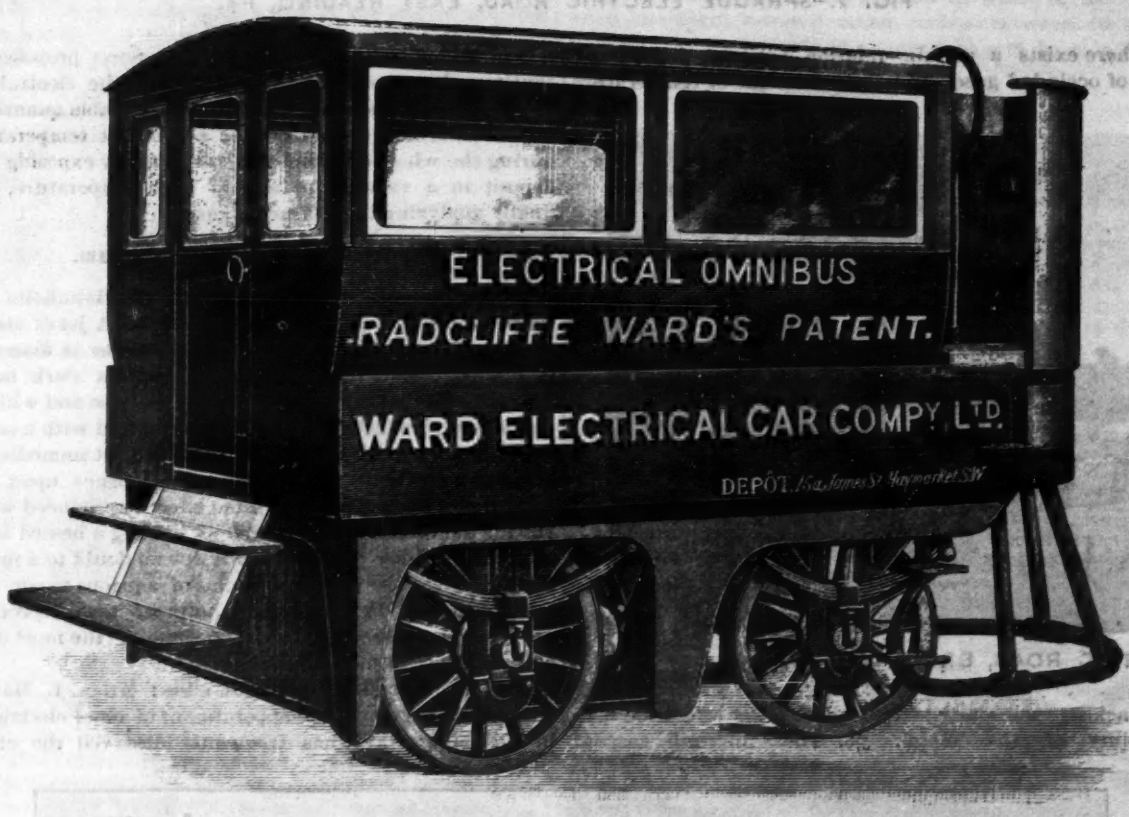
In directing a decree for the complainant in the suit of the American Bell Telephone Company against the Wallace Electric Telephone Company for infringement of patents, Judge Wallace, of the United States Circuit Court, says that there is nothing distinguishable in essentials in the above suit from those already decided by the courts, nor was anything materially new disclosed.

"No useful purpose," he states, "could be served by an extended discussion of the questions of law and fact which have been so exhaustively treated in the argument and brief of counsel for defendant, because nothing of interest can be added to what has already been said in the previous opinions of the courts. The construction which has been placed upon the Bell patent by the courts is, of course, to obtain now, unless it ought to be modified because something new in the state of the prior art has been shown. It would be strange if anything new of value could be shown after the thorough exploration and exposition of the subject made by the most competent experts and counsel in the efforts to defeat the patent and escape the charge of infringement in former litigation."

The usual decree for an injunction and accounting was ordered.

Ward's Electric Omnibus.

For some little time past there has been in operation on the streets of London an electrically propelled omnibus, designed by Mr. Radcliffe Ward, who was identified with



A LONDON ELECTRIC OMNIBUS.

some of the earliest attempts at electric traction in England. The vehicle, which is illustrated in the accompanying engraving taken from the London *Electrical Engineer*, has the appearance of something between an ordinary closed bus without top seats and an Adams Express wagon, of course without horses, and is capable of seating twelve persons comfortably. The driver sits or stands in front, with a switch and resistance frame, and handle with worm-gearing to steer with, and a powerful foot-brake. It is powerfully built to sustain the weight of accumulators, which slide in trays under the seats.

The cells are the new type E. P. S. traction cells, and were the first set of this type made by the Electrical Power Storage Company. The motors, of which there are two, are Gramme machines, built by Messrs. Crompton & Co., and have proved to be thoroughly reliable and efficient. They are connected with steel chain-gearing, which is also thoroughly satisfactory. Mr. Ward has tried all the available methods—friction, chain, belts, and toothed wheels. They all have advantages for special conditions, but he finds the gearing he has adopted the best for these circumstances. Double-speed gearing will be fitted for the cars used for ordinary work.

The speed of the car is about six to seven miles an hour, about the same speed as that of an ordinary bus. A run has been made without stopping, for instance, from Notting Hill to Golden square—a distance of 3½ miles in 30 minutes. The running of the car has not been attempted amongst the ordinary traffic in the daytime at present, but there would be no great difficulty about this, especially for heavy and slow-moving wagons, such as railway delivery vans, dustcarts, etc., and with proper means of thorough control these would admit of taking their place in a crowded string of vehicles in the thickest London streets. The question of the slip of wheels has been freely tested, the cars having been run successfully on the most slippery days. This is mostly a matter of sanding the road, and a sand-tube can be easily arranged in front of the wheels. At the same time there are in this case no horses to slip down. Another point is the saving in dust from the droppings. The wear and tear will also be less, for this is greatly due to the pounding of the horses' feet, like eight sledge-hammers on the pavement.

The Electric Blowpipe.

As is well known, when a magnet is brought in proximity to an electric arc, a dynamic attraction or repulsion occurs between the rectilinear current of the arc and the amperean currents of the field, and this results in the drawing or driving out of the arc into a point, which is very similar to the point of flame projected from a blowpipe.

This pecular behavior of the arc when placed in a strong magnetic field affords, according to Prof. Samuel Sheldon, a simple and efficient means for welding, and our illustration, taken from the *Scientific American*, shows the simplicity of the apparatus.

The heat at the point of the arc is intense, and suffices to melt any of the metals. A piece of No. 14 copper wire held at the apex melts instantly.

This extreme heat in such a convenient form can be the means of bringing electro-welding within the reach of all shops where arc lamps are employed for illumination. By a mere nominal alteration the lamp may be made to perform the double function of illumination and welding. To attain this end, a straight electro-magnet wound with coarse wire is only necessary. This is placed with one end toward the arc, and may be fixed in one position (to be determined by experiment, and depending upon the direction of the desired point of the arc), or made movable in a horizontal plane on a level with the arc. The two terminals of the magnet coil are inserted anywhere in the main circuit, or, if found necessary, may be shunted from the same. The connections, once made, can remain undisturbed, and, without influencing the main line, the lamp performs its two functions.

In the employment of the arc for electro-welding, the operator must, of course, wear colored glasses for the protection of the eyes. Care must be used in the selection of these, for some of the coloring matter used (especially in blue and red glasses) absorbs the light given out at the apex of the arc, and this would be detrimental to fine work.

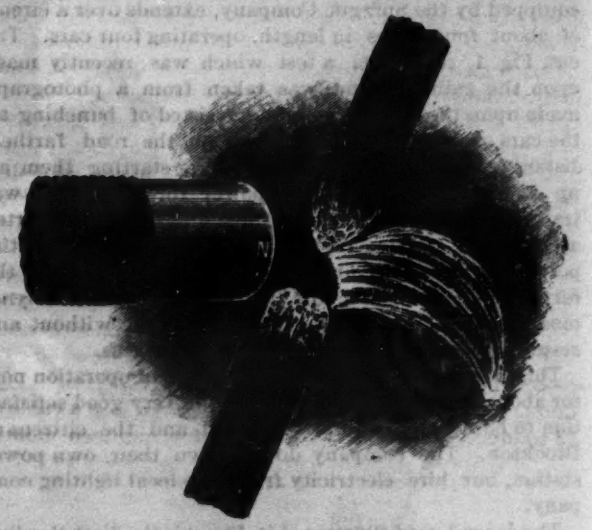
The electric arc, when in a strong magnetic field, exhibits another peculiarity. It is known that if a circuit, traversed by a strong current, be broken under ordinary circumstances, a moderate spark will ensue, accompanied by a snap similar to that given by a toy cap when exploded. If, however, the break be made in a strong magnetic field, an extremely large spark follows, accompanied by a peculiarly sibilant report, as intense as that of a pistol. The effect is very startling when unexpectedly made.

If a strong field be brought to bear upon the interrupter of the primary circuit of a Ruhmkorff coil, the spark emitted by the simple secondary coil equals in magnitude, and length that which would be produced under ordinary circumstances were the secondary in communication with a large condenser. This simple means may often be employed to advantage in work with a Ruhmkorff coil, when a long spark is desirable, and at the same time, any electrostatic residue, owing to the condensers, is to be avoided.

Lead vs Iron as Casing for Cables.

To the Editor of The Electrical World:

SIR: In your issue of January 19, there is a very interesting paper by Mr. E. G. Acheson, read before the American Institute of Electrical Engineers on January 8. In this paper he says: "It was desired to determine the



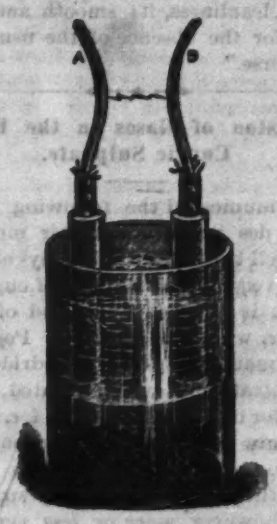
AN ELECTRIC BLOWPIPE.

cause of the occasional grounding and failures of cables used in telegraphic and telephonic circuits when, to all outward appearances, they were perfect in construction, protected by lightning arresters, and immediately before the moment of grounding indicated high insulation resistances." Mr. Acheson then proceeds to give an actual example in which a cable failed by reason of little spots of insulation carbonized by the passage of sparks. Mr. Acheson believes that these troubles were not introduced in the manufacture of the cable, nor that they were produced by working currents, which were of low electromotive force.

If a bubble or small body of air is introduced into the cable during manufacture, and it occupies a certain space, the coiling and uncoiling of a cable is liable to enlarge this space. We will suppose that by this means the space containing the air has been enlarged to twice its original dimensions; we have there then a partial vacuum which is easily sparked through. In my earlier uses of oil as an insulator, the oil would shrink and leave a partial vacuum inside of the pipe. Regarding the cable that I laid in 1881, between Waterloo Station and Clapham Junction, London, Mr. Goldstone, superintendent in charge, wrote me that they had "intermittent earth" when using currents of larger E. M. F. for working the Wheatstone instruments.

In 1882 I laid an underground system from Jersey City to Newark which tested very well, but sufficient caution was not used to exclude air from the pipes. When the temperature of the pipe and contents had fallen, these bodies of air became much enlarged from the shrinkage of the oil due to lowering of the temperature. This air space then became a partial vacuum easily sparked across by currents of more than average intensity.

In testing the wires with ordinary battery the insulation was good. But when dynamo currents from the Western Union office in New York were tried we had "intermittent earths," but more often intermittent crosses. The E. M. F. from these dynamos was about 300 volts on each wire, but with different polarities. The E. M. F. of one wire being 300 volts positive and on the adjoining wire



THE BROOKS EXPERIMENT.

300 volts negative, there was a potential difference between the two of 600 volts. And in this partial vacuum they would spark across. They were said to be "bobbing up and down." With an ordinary battery of 60 gravity cells there was no trouble.

A vacuum lightning protector shows no conductivity with an ordinary battery and astatic galvanometer. But currents of higher voltage spark through it. They are considered the best lightning protectors when inclosed in a glass bulb because they leave no charred and conducting path behind. Culley says: "The vacuum pro-

tector, consisting of platinum wires connected one to each of the line wires sealed in an exhausted glass bulb, answers perfectly." A vacuum in a cable is liable to ground a conductor in a cable without any previous indications of defective insulation. This is one cause of trouble with lead cables. For telephone purposes they do little or no mischief, as the current of a telephone transmitter is, or is supposed to be, about a fraction of a milliampère. But in using currents for arc lighting, the case is different.

I have thus far referred to one cause of trouble in lead-incased cables. Another is defective insulation, generally known as leaks, and these are increased and developed in proportion to the current used on them. The coiling and uncoiling of the lead is liable to open pin holes, which admit moisture, and one method of guarding this defect is to operate with low battery power. The first Atlantic cables were destroyed by using strong batteries. They work them now with a few cells. Upon this principle the German government work their underground circuits with 10 cells and relays of 1,000 ohms resistance. The English government use batteries of low electromotive force to prevent injury to their underground conductors. With these ideas in view, I have laid a cable of 53 conductors that has worked now for eighteen months without a single interruption or defect, and the insulation is even higher than when first laid.

In illustration of the relative difficulty of disruptive discharges in piercing air and other insulating materials, the following experiment will suffice: A glass jar is filled about one-third with a mixture of rosin oil, two cotton covered wires are twisted together, and the ends separated, as shown in the bottom of the jar in the illustration (page 88). The wires are heated in the mixture to 350 F. before being immersed, then two glass tubes are drawn over the wires, the tubes extending into the mixture below. Water is then poured on to the mixture, filling a portion of the jar, as shown in the figure. The wires are No. 16 gauge insulated to one-eighth of an inch diameter. Although the wires are separated from each other where twisted by less than one-eighth of an inch, if we apply the two poles of a Holtz machine at the ends *A* and *B*, we can pass a spark between the bare portions of the wire two inches in length, before the current can be made to pass through the covering of the wires when twisted together. It will be seen how easy it is to protect the insulation from disruptive discharges. Iron pipe is a thorough and radical "cure" or rather preventive of "pinholes." If we substitute paraffine in place of rosin and rosin oil mixture, the water penetrates the paraffine, although it has been allowed to cool and become seemingly solid, the insulation between the wires fails.

The insulation employed in my system is in the nature of a liquid, and it expands and contracts by variations of temperature. The pipe can be considered a kind of horizontal thermometer, and if a defect of the slightest degree occurs it is broken up by the alternate movements or motion of the insulation backward and forward; while in an insulation of a solid nature a defect is a permanent thing, increasing by time until it becomes an absolute ground.

DAVID BROOKS.

PHILADELPHIA, Pa.

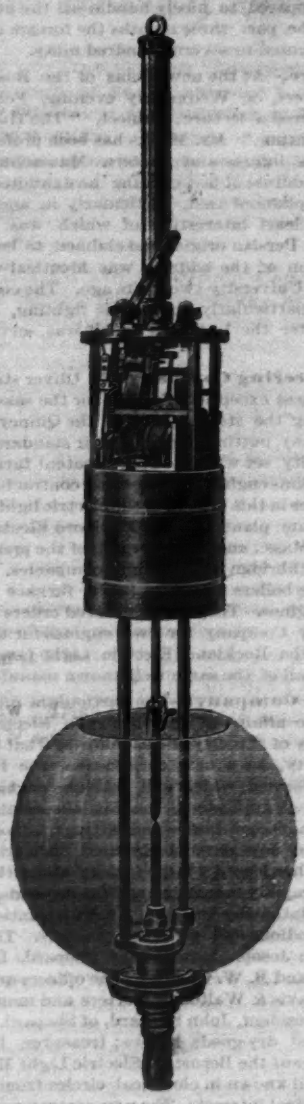
The New Sperry Dynamo and Lamp.

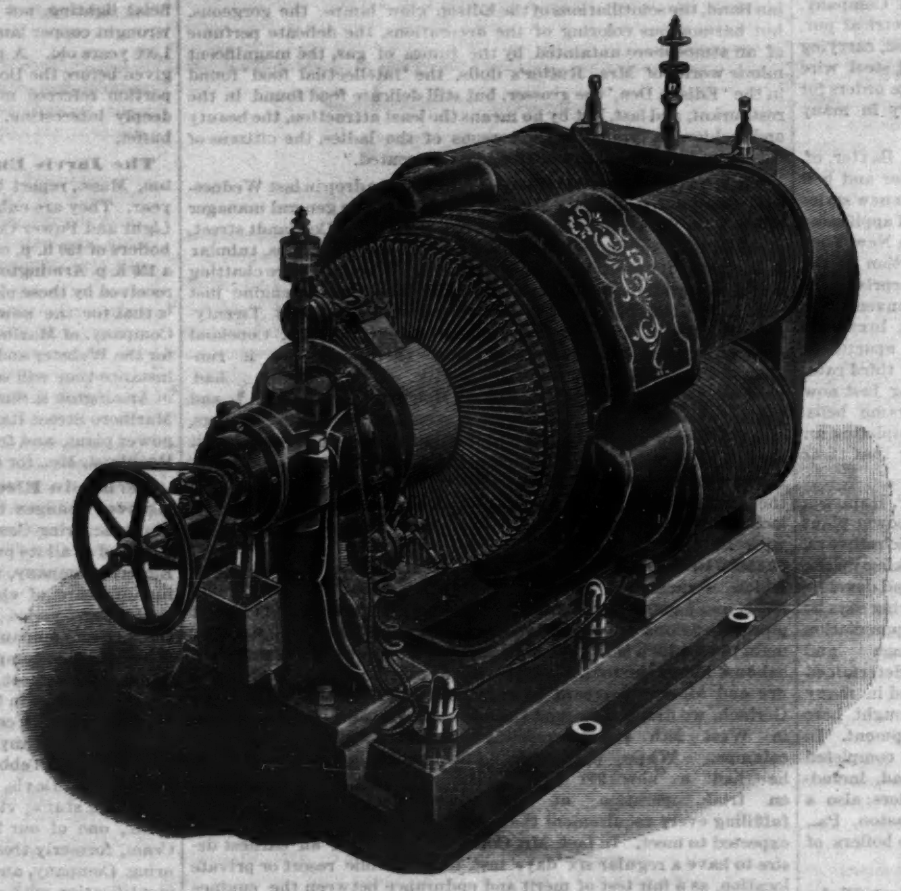
The system of arc lighting of the Sperry Electric Company will already be familiar to our readers, having been described in our columns some time since. Recently, however, the apparatus has undergone a number of marked improvements, the principal being those in the dynamo and lamp.

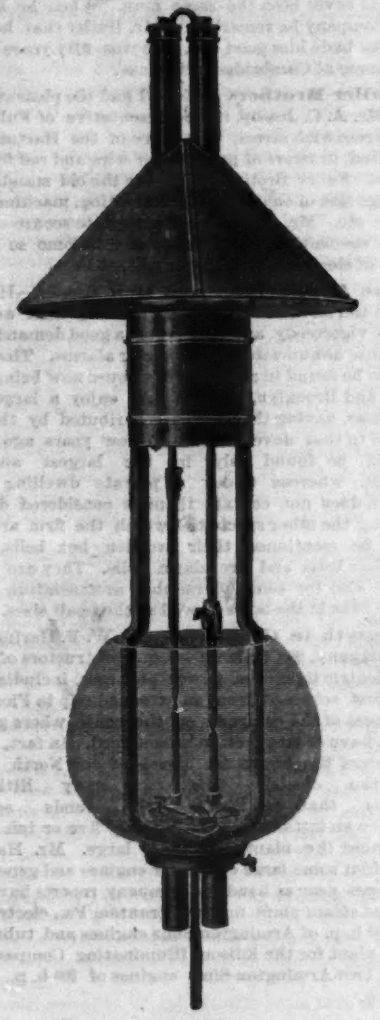
The dynamo, as shown in Fig. 2, has field magnets with internal pole pieces, so that the wire on the interior of the ring is under the influence of the field magnets.

A special feature of the new Sperry dynamo is the automatic regulator. The brushes consist of overlapping flat copper strips attached to a movable yoke, which is connected by means of an arm to an electro-magnetic regulator placed in the lamp circuit. Any variation in the electrical resistance of the lamp circuit operates the keeper of the electro-magnet. By an ingenious device this movement adjusts the current of the dynamo in proportion to the variation in the resistance of the lamp circuit. It is claimed that 75 per cent. of the total number of arc lamps may be instantly switched out without the least danger to the machine. This, of course, is a very valuable feature, especially for central station lighting.

Figs. 1 and 3 show the Sperry single and double arc lamps. Each lamp is provided with an ordinary hand-switch, and also with an automatic cut-out, which operates in case the carbons are burnt out or the arc elongates from the imperfect working of the mechanism. The regulation of the lamp is such that the carbon rod is made to automatically move in both directions up or down. When the lamp starts the normal arc is at once secured and maintained throughout the entire operation.







FIGS. 1, 2 AND 3.—THE IMPROVED SPERRY ARC LIGHTING SYSTEM.

Electric Lighting and Health.

Electric lighting, as a means of preserving and promoting health, has not, say *Health*, been sufficiently appreciated by the British public. It may be safely said that electric light is the only form of artificial illumination which is not injurious to health. This is a strong argument in favor of the general introduction of the electric light, but it is when we begin to compare this light with that of gas, or any other artificial lights, that its beauty, purity, brightness, cleanliness and safety come out in strong contrast.

Gas not only consumes and pollutes the air but it is very poisonous, besides having a deleterious effect on the furniture and decorations of our homes. Gas gives off a certain amount of soot, which is evident from the blackened ceilings and cornices, discolored wall paper, etc. The destruction to goods in the shops of our great cities from the action of gas must also be very great. In offices, shops and factories employés can use it continuously without feeling the lassitude, headache and fatigue which are frequently caused by the use of gas. As a means of retaining health its advantages are indisputable.

It has been said, with a considerable degree of truth, that every hour a man spends in a room lighted by gas tends to shorten his life and abridge his powers of work. The light is a pure, healthy light, which, if no other light were used and the smoke of our fires self-consuming, would leave our cities almost as fresh and bracing as a Highland hill, and rosy instead of pale cheeks, and brightly-flashing instead of dim, lustreless eyes would mark the city inhabitants.

Telegraphic Service in Canada.

A special dispatch of Jan. 19 from Ottawa, Ont., says: "A well-known firm of electricians in this city have secured the contract for the construction of a connecting link between the Mackay-Bennett cable at Canso, Nova Scotia, and the Canadian Pacific Telegraph system at St. John, New Brunswick. Commercial men and journalists are jubilant over the prospect of such a formidable competition to the Western Union, which has hitherto had a monopoly of the telegraph service in the Atlantic or Eastern provinces. Messrs. Ahern & Soper, the contractors, state that arrangements are already completed for the commencement of the work in time to insure its completion by August next. The lines are to be specially heavy to secure permanence and steady service, the electric conductors to be used being larger than any hitherto erected in Canada. This new connection, apart from its importance to the mercantile public, is likely to prove a boon to Canadian newspapers, which heretofore have received their foreign cable dispatches via New York, and have had to be satisfied with such news as the New York Press Association saw fit to send forward. These meagre reports were often misleading and unsatisfactory, and have been a general source of complaint for several years. The Canadian Pacific Telegraph Company is an adjunct of the Canadian Pacific Railway Company, and their lines have already penetrated nearly every portion of the Dominion. Their connection with the Mackay-Bennett cable is looked upon here as the finishing stroke to the monopoly hitherto existing, and almost equal in importance to the completion of their line of railway, which so effectually shattered the Canadian railway combines which had previously crippled the inland transportation service of Canada."

A Bulled Message.—Not long ago a Boston publishing house received the following telegraphic dispatch: "Send books A. Walkin' Hell as author D. J. Snider, West, Rian Bookstore." The members of the firm were very much puzzled until they received a corrected dispatch, which read: "Send book, A Walk in Hellas, author D. J. Snider, Wesleyan Bookstore."

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Feb. 11, 1889.

A Lecture on Alternating Currents.—On the evening of Feb. 6. Prof. Henry Morton delivered a lecture before the New York Board of Fire Underwriters on "Alternating Currents." The lecturer demonstrated by numerous experiments the nature of alternating currents and their scientific and practical application to the distribution of electricity.

Church Lighting.—Mr. W. H. Cole, the electrical engineer and superintendent of the West Side Electric Light and Power Company, 502 W. 53d street, tells me that he is making a special study of the massive Paulists' church at 59th street and Ninth avenue for lighting from that new central station. The church is one of the largest and most solid structures of its kind in the city, and it will take about 500 lights.

The Macraeon Storage Battery.—Mr. A. C. Kendall, general manager of the Macraeon Storage Battery Company, 7 Wall street, has recently returned home from the northern part of this State, where he has been engaged in installing a secondary battery plant of 46 cells, type C, for Allen Brothers, and 46 cells of type B, for Howland & Company, both of Sandy Hill, New York. Mr. Kendall reports having a number of other installations on the way and a large number of estimates out.

The Butler Hard Rubber Company has recently sustained a loss in the death of Mr. J. L. Collyer. This gentleman, who was very popular in electrical circles, became connected with the company in 1880. The loss of his wife last fall seemed to affect him and he has never been the same man. When he last left the office of the company he remarked to Mr. Butler that he might not return and he bade him good bye. He was fifty years of age and died at his home at Cambridgeport, Mass.

Fuller Brothers & Co.—I had the pleasure last week of meeting Mr. A. C. Jessop, the representative of Fuller Brothers & Co., 139 Greenwich street, the office of the Hartman Steel Company, Limited, drawers of pure copper wire and rod for all electrical purposes. Fuller Brothers & Co. are the old standard house, carrying a large line of cold die rolled shafting, machinery steel, steel wire nails, etc. Mr. Jessop is determined to secure some large orders for these specialties, which have now become so necessary in many lines of electrical manufacture.

The Annunciator and Bell Trade.—H. E. & C. Baxter, of 18 Fulton street, Brooklyn, are pushing their annunciator and bell trade vigorously, and they report a good demand for their new styles of house annunciators and burglar alarms. These useful appliances are to be found in almost every house now being built in New York City and Brooklyn, and this firm enjoy a large proportion of the business, having themselves contributed by their enterprise very much to that development. A few years ago such conveniences would be found only in the largest and most luxurious homes, whereas to-day a private dwelling or an apartment which does not contain them is considered decidedly third rate. Among the other specialties which the firm are pushing just now may be mentioned their wooden box bells, iron frame bells iron box bells and fire alarm bells. They are now completing an order also for some 100-number annunciators, showing that their trade runs in the large as well as the small sizes.

Growth in the South.—Mr. W. F. Haring, of E. P. Hampson & Company, 36 Cortlandt street, constructors of steam power plant for electric light and power purposes, including electric railways, has just returned from an extended trip to Florida, looking up the business of the company on the route, where growth and development have of late been so pronounced. In fact, Mr. Haring says he considers the South far ahead of the North in its appreciation of the electric light, as every little village and hamlet that can raise the funds seems determined to have an installation, if it be only five or ten arcs, and in many instances the plants are quite large. Mr. Haring brought here with him some large orders for engines and general equipment. In business near at hand the company reports having just completed a large steam plant for the Scranton, Pa., electric railroad, including 350 h. p. of Armington-Sims engines and tubular boilers; also a large plant for the Edison Illuminating Company, of Easton, Pa., being two Armington-Sims engines of 200 h. p., and two boilers of 225 h. p.

Pearce & Jones, of 79 John street, this city, have just filled a foreign order for about 100 district registers of their latest improved design. There are many features in these registers that are making them favorably known in the growing field of the district messenger service. The firm also report some excellent modifications in their telegraph keys, sounders, bells, call boxes, etc. They are now making some very fine relays mounted on handsome marble bases. All those in use at the new fire headquarters are of this style, with pretty colored hard rubber magnet covers. It will doubtless be remembered that this house makes a specialty of all kinds of experimental models and machinery, and in this line they are also as busy as possible. Besides carrying a full line of fire alarm and district outfits, they are also contractors for, and constructors of, fire alarm telegraph plants for city, town or factory. Among their miscellaneous products may be mentioned resistance boxes, switchboards and all the other details of telegraph, telephone, electric light and electric railway plants on any scale.

The Advantages of Dry Steam.—Although perhaps, at first, the managers of electric light stations were not so alive as they might have been to the advantages and even necessity of employing dry steam in order to obtain the maximum conditions of economy, efficiency and safety, I think, at the present time they are becoming aware of the importance of the matter, and are seeking information with regard to it. It will be remembered that at the time of the exhibition of the American Institute Fair, great attention was attracted by the Stratton mechanical separator for this purpose; and since that time this separator has been adopted for a large number of plants, including those of the United States and Mount Morris companies of this city, as well as for the Edison laboratory, where, I believe, everything has to be the very best of its kind. This separator is manufactured by the Stratton Separator Company, office of the Goubert Feed Water Heater Company, 18 Cortlandt street, New York City, who will be glad to furnish all desired information on the subject, and whose very interesting pamphlet with regard to it I would recommend for the careful perusal of all who have to operate electric light plants, whether large or small.

Red Core.—Mr. A. C. Shaw, the popular representative of the Callender Company, showed me last week some samples of the much talked of red core, which, owing to the ingenious manner in which the preliminary announcements were made with regard to it in your columns, has had probably the best advertising of anything this year. As it has been in everybody's mouth, it is now to be in everybody's plant. Mr. Shaw considers red core the panacea for all the evils that electric lighting is heir to, including grounds and troubles of every description. The toughness and tenacity of this red core insulation for indoor wiring, etc., was brought very forcibly to my attention when I was suspended in mid-air by a piece of No. 16 core. I don't exactly remember what my fighting weight is, but I believe it is in the neighborhood of 180 pounds, so that the strain on the sample was not a small one. This little test certainly gave me a good idea of its durability in some directions, and if it be equaled in other respects, as Mr. Shaw claims it is, it certainly will have a great future, especially as it is to be pushed with all the energy and enterprise that the Callender Company can command.

"Edison's Den."—A novel feature at charity fairs is certainly that which has received the appellation of "Edison's Den." I quote the following in regard to it from the *Times:* "Success is attending the fair—'St. Valentine's Market'—in progress at 489 Fifth avenue, near Forty-second street, for the benefit of the Manhattan Dispensary Hospital, which is natural enough considering the elements of interest that are in it. Especially attractive is the exhibition given of the wonders of the phonograph and telephone. Mrs. Edward H. Johnson has in charge what is known as the 'Edison Den,' where these exhibits are given with the personal co-operation of Mr. Edison, who daily consigns to Mrs. Johnson's care the latest improvements and newest applications, the latest arrival being a wonderful talking doll. This particular application of Edison's great invention finds its chief admirers in the ladies and the little girls, but is nevertheless a magnet of sufficient power to attract the sterner sex. The 'Edison Den' is, in fact, simply an annex to Edison's laboratory, and visitors to it can see very clearly the approach of what Mr. Edison says will be the next great invention—the combination of these two inventions into one instrument, which will be nothing more or less than a recording telephone. Those who harbor doubts of the possibility or practicability of this application should visit the St. Valentine's Market and have them removed, and at the same time contribute to the charity which all this charming entertainment is designed to benefit. The beauty and exquisite taste displayed in the decoration, as well as the magnificent display of electric light, are the most effective that have ever been seen in this city. With the magnificent music of the Hungarian Band, the scintillations of the Edison 'glow' lamps, the gorgeous, but harmonious coloring of the decorations, the delicate perfume of an atmosphere untainted by the fumes of gas, the magnificent mimic world of Mrs. Rutter's dolls, the 'intellectual food' found in the 'Edison Den,' the grosser, but still delicate food found in the restaurant, and last, but by no means the least attraction, the beauty and fashion, as typified in the persons of the ladies, the citizens of this town have an opportunity seldom presented."

An Engine Competition.—I happened to drop in last Wednesday, about 6 o'clock, upon Mr. E. T. Copeland, the general manager of the New York Safety Steam Power Company, 30 Cortlandt street, manufacturers of high-class automatic high-speed engines, tubular boilers, etc., for electric lighting purposes. While we were chatting one of his employés came in and informed him that the engine just put in for the big Gerlach apartment house in West Twenty-seventh street, was already running, whereupon Mr. Copeland suggested that I accompany him there and see it running, which I did with alacrity. The engine had been delivered at the Gerlach only on Monday morning, Feb. 4, and in the meantime it had been located, with all the piping, fittings, etc., and a new plaster ceiling had been put up over it, so that it seemed hard to believe the engine could already be in operation. There was no mistake about it, however, for on our arrival we found the engine running smoothly and noiselessly, and Mr. Charles Gerlach, the proprietor, not only expressed himself as delighted with it, but invited Mr. Copeland to send in intending purchasers to inspect the plant. One great feature of this plant which struck me was that it exhausted without any noise, and I noted that a number of cushions were set in the exhaust pipe at various points before the connection was made with the main pipe, which is 125 feet high, and which allowed the engine to exhaust above the roof. These cushions overcome the back pressure and allow the steam to pass off freely. After leaving the Gerlach, we dropped around the corner to the new Edison station in West 26th street, recently described in full in your columns. While there Mr. Copeland informed me that he had a new 250 h. p. automatic high speed engine on trial operation at his factory, and that it was fulfilling every requirement that such a powerful engine could be expected to meet. In fact, Mr. Copeland expressed an earnest desire to have a regular six days' test, in any public resort or private location, as a fair test of merit and endurance between the engines of his company and any other noted engines of the same class, the testing to be determined on the perfection of regulation in any given time, and under any given conditions of load. The engine for this test, he considered, should be between 80 and 100 h. p.; the run to be at a continuous speed of 300 revolutions a minute and at various loads, and the tests to be for economy, noiselessness, friction and average development of power each engine to run 24 hours per day for the 6 days, giving a total of 2½ millions of revolutions in the day. The test should be made with Mosscrop speed recorder and Edson steam pressure recording gauges, and Van Winkle dynamometer, indicator cards being taken at various times during the run.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, 146 Franklin St. and 149 Congress St.
BOSTON, Feb. 11, 1889.

Removal.—The Municipal Signal Company, of Boston, has removed its offices from 51 and 53 State street to No. 79 Franklin street, corner of Arch.

Allston Power Station.—The West End Railway Company of Boston has given an order to the Jarvis Engineering Company to enlarge the power station at Allston, Mass., to double its present capacity.

Personals.—Mr. George T. Manson, of the Okonite Company, New York, and Mr. Henry D. Stanley, of Bridgeport, have been in Boston for several days. Mr. S. M. Hamill, Jr., of the Brush Company, has also been a visitor.

New Electrical House.—Buck & Spaulding is the firm name of a new electrical concern just located in the Hathaway Building, Boston. This firm intend to handle electric motors and act as agents for a general line of electrical goods.

Proposed Electric Elevated Road.—A petition signed by Messrs. Ames, Shepard, Lamson, Currier and Rust has been presented to the Massachusetts Legislature for incorporation as the Boston Electric Elevated Railroad Company.

Temporary Electric Lighting.—Messrs. John T. Moriarty and H. C. Wirt, of Boston, are meeting with considerable encouragement in their new enterprise. Their temporary electric lighting system is attracting a good deal of attention and favorable comment in and around the "Hub." Through the liberal co-operation of Manager C. L. Edgar, of the Edison Electric and Illuminating Company of Boston, the firm named has secured orders for lighting several of the palatial residences in the back-bay district with their temporary system.

Electric Lights for Bangor.—The City Council of Bangor, Me., has voted to make a contract with the Brush Electric Company, of Cleveland, O., for a municipal plant to cost about $26,000. This sum will be the net total cost of the plant in complete running order.

Personal.—Mr. J. H. Findlay, president of the Gas and Electric Light Company at Ogdensburg, N. Y., was in Boston for a few days last week. During his short stay at the Hub Mr. Findlay favored my office with a visit, and was also a welcome guest at the rooms of the Boston Electric Club.

Schaefer Incandescent Lamps.—The steady growing demand for this popular lamp has necessitated the establishment of a Western agency by the Schaefer Electric Manufacturing Company. Mr. Geo. A. Harmount, the Western agent of the New Haven Clock Company, No. 315 to 321 Wabash avenue, Chicago, will hereafter look after the Western interests of the Schaefer Company.

"Simplex" Wire.—The last week in November, 1888, one of the largest of the factories of the Simplex Electrical Company, together with every piece of machinery, was destroyed by fire. While the flames were still raging, orders were telegraphed for a complete new outfit of machinery and tools, and on the first day of the present month the company's new factory (finished last month) was equipped from basement to roof with the requisite material and workmen for turning out immense quantities of wire. The company are now in a position to catch up on all the old orders, and at the same time are prepared to nicely handle all the new orders that come in. During the past three months the foreign orders for Simplex wire have amounted to several hundred miles.

Interesting Lecture.—At the new rooms of the Boston Electric Club, No. 7 Park street, on Wednesday evening, Feb. 6, Hon. Richard J. Monks delivered a lecture; subject, "The History and Growth of Artificial Lighting." Mr. Monks has been professionally connected with the gas interests of Eastern Massachusetts for many years, and in his address of last evening he exhibited several valuable and curious appliances used, particularly in ancient artificial lighting, not the least interesting of which was a finely wrought copper lamp of Persian origin, and claimed to be at least 1,000 years old. A portion of the address was identical with that given before the Boston University two years ago. The concluding portion referred more particularly to electric lighting, and was deeply interesting. After the lecture a lunch was served in the buffet.

The Jarvis Engineering Company, 61 Oliver street, Boston, Mass., report business exceptionally good for the season of the year. They are enlarging the steam plant of the Quincy Electric Light and Power Company, putting in one of their standard tubular boilers of 150 h. p. capacity, set with the Jarvis patent furnace, and a 150 h. p. Armington & Sims engine. Among other contracts recently received by these pioneers in this branch of the electric light business is that for the new steam plant for the Marlboro Electric Light Company, of Marlboro, Mass., and the enlarging of the present ones for the Webster and Southbridge Electric light companies. In each instance they will set the boilers with the Jarvis furnace and put in Armington & Sims engines. They have received orders from the Marlboro Street Railway Company for two engines for their new power plant, and from the Rockland Electric Light Company, of Rockland, Me., for one, all of the same well known manufacture.

Bernstein Electric Company.—The particulars of recently reported changes in the affairs of the Bernstein Electric Light Manufacturing Company of this city are as follows: That company disposed of all its property, and a new corporation, the Bernstein Electric Company, was formed, which will actively engage in the manufacture of electrical appliances, making a specialty of the well-known series incandescent lamps and fittings introduced by the former company and now extensively used throughout the country. The company has leased a large factory at South Boston to enable it to meet the rapidly increasing call for its goods, and has located its office in the Hathaway building, No. 620 Atlantic avenue, where it has very commodious and pleasant quarters. The directors of the company are: Joseph Davis, John Shepard, Luther S. Johnson, C. B. Tebbetts and B. W. Currier. The officers are: President, Joseph Davis, of Davis & Walton, importers and manufacturers of dye stuffs; vice-president, John Shepard, of Shepard, Norwell & Co., one of our largest dry-goods houses; treasurer, Henry B. Cram, formerly treasurer of the Bernstein Electric Light Manufacturing Company, and well known in electrical circles from his long identification with electrical interests. The new company enters the field well equipped, being financially strong and having for its officers gentlemen of known standing, ability and business push.

Street Railway Men Visit the West End Road.—On Tuesday, Feb. 5, there was a notable gathering of prominent street railway men of New England who had come from all quarters of the six New England States. The object of the gathering was to inspect the electric branch of the West End Road at Boston, installed by the Sprague Electric Railway and Motor Company, of New York. The party was met by Messrs. Blake & Sawyer and the start was made from the Park Square end of the line in a number of electric cars, which President Whitney of the West End Road had provided for the purpose. The first stop was made at the power station for the road, situated at Allston, where the visitors disembarked, and were shown the generating station for the electricity used in operating the cars. On entering the main room and passing by the two majestic high speed Armington & Sims engines of 200 h. p. each, one, though running, being so noiseless in its action that its motion passed almost unnoticed, the four monster dynamos, of 80,000 watts capacity each, engaged the attention of the party. From each dynamo there are three leads passing under the floor to the switch-board, where connection is made by separate conductors to the underground conduit and overhead system. This switch-board and each regulator have for their bases an insulating compound to which they are fastened, and the regulator shaft carries a gear so that by means of a rack which meshes into all four gears, the four dynamos may be regulated by one operation. Still higher on the wall are the safety fusible strips mounted on slate. At the top of the switch-board are placed four improved lightning arresters resting on insulated brackets. These arresters consist of a large electro-magnet, which may be short circuited in fine weather by a switch. From the terminal connected with the outside line there is a circuit with an alternative path to the ground with the use of the usual break, an electro-magnet. To a lightning current passing over the line, the large electro-magnet acts like a choking coil and offers a large resistance, and the current, taking the alternative path, jumps over the air space when the electro-magnet operating breaks the circuit, thus extinguishing the arc. The power station is brilliantly lighted by a large number o electroliers under control in groups of five at a switch-board at one end of the building.

The boiler house has three 150 h. p. steel tubular boilers, with Jarvis setting, feed-water heater, injector, steam pump, etc. The back wall of the power house is built with a view to its extension in the rear, so that the capacity at the station can be doubled, the po

sition of the chimney being in the centre of the future station. Adjoining the power station a new car house has been erected with capacity for 25 cars. The cars, when in this house, rest on skeleton tracks, under which the inspectors can walk, and by aid of incandescent lamps with flexible connections, can examine and inspect the machinery of each car.

After the party had fully examined the workings of the power station and listened to the lucid explanations of its operation from the engineer in charge, they re-boarded the electric cars which were standing in waiting outside, and were carried quickly out Beacon street and Harvard avenue to the terminus of the road at Oak Square, Brighton. To a great many in the party this trip was the first ever made on an electric railway, and the exclamations of surprise and delight were universal. On the return trip the cars were speeded to ten or twelve miles an hour in places, and much praise was bestowed upon the starting, which was prompt, though without jar; the complete control over the car and the ease of the same in rounding curves and in speeding.

Each of the cars was lighted by five incandescent lights of 16 candle-power each, three inside the car and one on each platform. These lamps have the municipal cut-out, and when one breaks the increase of c. p. in the remainder calls the attention of the conductor, who inserts a new lamp.

Not the least enjoyable feature of the entertainment was the collation which was provided at the Hotel Thorndike. The guests and visitors were full in their praises of the operation of the road, and many congratulations were given to the Sprague Railway representatives present and to the West End officials upon so successful an operation of the road.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., Feb. 11, 1889.

The Borough of South Chester has advertised for bids for lighting the streets with incandescent lights. The post-office address is Thurlow, Pa.

The Philadelphia & Reading Railroad Company has just closed a contract with the Edison Company for furnishing their ferry boats running between Walnut street, this city, and Kaighn's Point, Camden, with electric lights. A 60-light machine will be placed in each boat.

The American Life Insurance Company recently asked for bids for lighting their new building at Fourth and Walnut streets with electric lights. The Edison Company through their agents Messrs. Walker & Keppler has just secured the contract, and will put 350 lamps in position.

The Philadelphia Electrical Society met on Saturday evening last and listened to a very interesting talk by Mr. W. McDevitt on "Dangers of Electric Lighting—Investigation of the Temple Fire." Mr. McDevitt is chief inspector of the Insurance Patrol, and gave some amusing instances of attempts to evade the underwriters' regulations.

Electric Lights in the Bucks County Towns.—Last week a large meeting of citizens of Hulmeville, Eden and Langhorne, Bucks County, was held at the latter town on Thursday night, for the purpose of considering the introduction of electric lights into those places. A company was organized to secure a plant, and $13,000 worth of stock was subscribed for.

The Edison Electric Light Company began on Wednesday to store coal in the immense plant on Sansom street above Ninth. A new style of wagon is used in carrying the coal from the yard. It will hold three tons, and has a hopper bottom like the ordinary railway coal car. A load of three tons was unloaded yesterday in 30 seconds. When active work shall be begun by the Edison Company at the new plant, from 35 to 100 tons of coal will be consumed daily.

An Immense Plant.—The grand store of Mr. John Wanamaker, corner of Thirteenth and Chestnut streets, is said to contain more arc lights than any other building in the whole world. Over 400 lights are scattered under the roof of the vast edifice, and the darkest days do not affect the business of the establishment, which demands good, strong light. When it is realized that not many towns contain 400 arc lights through the streets, the immensity of this plant, which covers only one city square in area, may be imagined.

Messrs. Warren, Walker & Co., makers of the patent vacuum feed-water heater, at No. 490 North Third street, have been exceedingly busy putting their heaters in electric light stations. They recently put a 800 h. p. heater in the York Electric Light Company's plant, and have furnished heaters for the Edison Illuminating Company, Lancaster, Pa.; Wissahickon Electric Light Company, of this city, and several others. The Pencoyd Iron Works have just sent in their third order for the heater, and the Phœnix Iron Company, of Phœnixville, Pa., recently duplicated an order for a two thousand horse-power heater.

Engines, etc., for Electric Lighting.—I am in receipt of the following particulars of plants and installations from the foundry and machine department of the Harrisburg Car Manufacturing Co: "We have just received from the Committee of Award at the National Exhibition of Augusta, Ga., the highest premium on one 100 h. p. Ide engine, which was running the machinery at that place. The award is for fine construction and material, and for the perfection of its regulation. Since our last report, in November, we have received orders for one 125 h. p. Ide engine and return tubular boiler, with pump, heater, piping, etc., together with the Weitmeyer furnace, for the electric light station at Harrison, N. J. Also an order for one 125 h. p. Ide engine, boiler, heater, &c., for the Perth Amboy Electric Light Company, N. J., with Weitmeyer furnace. Also an order for two 54-inch return tubular boilers for Troy, Ala., and two 48-inch return tubular boilers for J. Walker Bates, New York. All these boilers are complete, with fronts, stack, fittings, &c. One 150 h. p. compound Ide engine for Jno. Post, Jr., & Co., Boston. One 12 by 18 Ide engine for Columbus, Ga. Also one 50 h. p. Ide automatic engine and return tubular boiler, with pump, heater, fixtures, etc., including the Weitmeyer furnace, for the Sands Hill Hotel Company, of Augusta, Ga. We have just started the plant of the Kingston Electric Company, at Kingston, Pa., where we have in operation a 50 h. p. Ide engine, with a 60 h. p. return tubular boiler, including the Weitmeyer furnace, etc. This plant moved off successfully at the start, and is receiving the highest testimonials from every one connected with the station."

James W. Queen & Co.—I hear from James W. Queen & Co. that Professors Ayrton and Perry have informed them that they had made new arrangements for the manufacture of their world renowned spring annunciators and voltmetres. From what people seem to think about these instruments there is a divided opinion among electricians as to their actual merits. It may be confidently stated that the principles involved in the Ayrton & Perry meters class them among the most sensitive and accurate instruments, provided they are well made in all respects. Professors Ayrton and Perry give their assurance to Queen & Co., which firm is the sole and exclusive agent for the United States for their old, new and newest instruments, that they have engaged one of the most reliable English manufacturing houses, to carry on the manufacture of their spring instruments of older patterns, as well as their combination spring instruments, and a voltmeter for direct and alternating current. All these instruments will be of the best workmanship, and furnished with certificates from Professors Ayrton and Perry as to their accuracy. One of the latest instruments of these two eminent electricians is their secohmmeter, destined to determine coefficients of self-induction. We understand, besides, that in the course of a few weeks there will be a new combination instrument in the market, constructed in the Queen laboratory, and manufactured in the Queen shops. It promises, from what their electrician explained, to be a decided advance in the line of compact testing instruments, combining slide wire, bridge, rheostat, galvanometer and battery in a box of 10 x 10 x 6 inches.

Franklin Institute.—Mr. W. J. Hammer, of Orange, N. J., lectured on "Edison and His Inventions" before an audience which crowded the Institute Hall, on Monday night. Many of Mr. Edison's inventions were exhibited, and large drawings of them were shown, which clearly illustrated the manner of construction. The chief features were the exhibitions of the long distance telephone, the phonograph, and both combined. The audience was treated to a cornet solo performed in New York, and which was transmitted through the long distance telephone over 103 miles of wire, six miles of which were under ground. The notes were rather sharp and metallic, but clear and distinct, and every note and variation was heard throughout the hall. The short sharp trills by which the expert cornetist delights to display his skill were as well defined as the prolonged notes.

After the cornet solo, Miss Stewart, the soprano of the New York Cathedral, sang. Then followed another cornet solo transmitted from a phonograph attached to the 'phone in New York, and the notes could be heard as distinctly as if the phonograph had been in the same room as its auditors. This experiment was repeated three times, the same roller in the same phonograph in New York being used, to show that the instrument could repeat itself indefinitely. The third performance was as successful as the first. Then a phonograph was attached to the telephone at this end of the line and a New York phonograph a fourth time repeated its cornet solo, the telephone receiver being held within a few inches of the long funnel which carried the sounds into a phonograph on a table. The Philadelphia phonograph then reproduced the music for the benefit of the audience, and while the sounds were somewhat fainter than when heard from the telephone, they were still distinct. This last was a reproduction of music at fourth hand. First it had been played into the New York phonograph, then transmitted over the telephone to the phonograph in this city and then given to the audience.

E. F. C.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Feb. 9, 1889.

Rensselaer, Ind.—Mr. B. F. Ferguson will put in 300 alternating incandescent lights of the Thomson-Houston system.

Personal.—Mr. F. H. Wilkins, of the New York branch of the Western Electric Company, is in the city for a short visit.

Frankfort, Ky.—The Capital City Gas Company, of Frankfort, have just purchased of the Western Electric Company, Chicago, 50 arc lights.

Astoria, Oregon.—The Western Department of the Thomson-Houston Company have just shipped to this point an arc plant of 50-light capacity.

St. Louis, Mo.—Messrs. B. Nugent & Bro. are to light up their works with 25 arc and 300 incandescent lights of the direct current Thomson-Houston system.

Troy, O.—The Troy Electric Light and Power Company, of this city, have just purchased an incandescent plant consisting of 600 lights of the Thomson-Houston alternating system.

Negaunee, Mich.—The Pioneer Furnace Company are to install an arc light plant consisting of 25 lights, the contract for which has just been given to the Western Electric Company, Chicago.

Nashville, Tenn.—A plant consisting of 150 arc and 600 alternating incandescent lights has just been sold for shipment to this city by the Western Department of the Thomson-Houston Company.

Grand Rapids, Mich.—The Edison Electric Light & Fuel Gas Company of this city are putting in an arc plant consisting of 100 lights purchased from the Western Department of the Thomson-Houston Company.

Streator, Ill.—The People's Electric Light Company of this city have increased their capital stock to $25,000, to accommodate the increased business made necessary by the increase to 800 lights of the Mayo incandescent system.

Goodrich, Tenn.—The Warner Iron Company, Nashville, Tenn., having become acquainted with the Thomson-Houston system from its use at their works in that city, have purchased for their plant at Goodrich, a 24 arc light machine.

Clinton, Ill.—Mr. A. Woodard has just purchased of the Van Depoele Company, Chicago, 20 arc lights and 300 series incandescent lights. The city has agreed to use 10 of the arc lights for city lighting. The others will be used for commercial purposes.

Baton Rouge, La.—The Baton Rouge Electric Light and Power Company are to put in a central station. The installation will consist of 50 arc lights and 500 incandescent, the contract for which has just been placed with the Van Depoele Electric Manufacturing Company, Chicago. The local company has contracted to supply the city with 25 arc lights, the remainder will be used for commercial purposes.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$149@$152	Iowa Union	23@ 25
Central Union	48@ 49	Michigan	79@ 80
Chicago	300@ 305	Missouri and Kansas	71@ 72
Colorado	40@ 41	Rocky Mountain Bell	39@ 40
Cumberland	65@ 68	Wisconsin	115@ 117
Great Southern	30@ 35		

Preparing for the Convention.—Spaces for the exhibits at the coming Convention have, I learn, been assigned, and many exhibitors will soon have their displays in position. Under the efficient direction of Mr. F. N. Bosson, who has the immediate charge of all these matters, the work of laying the track for the electric railway, the arrangement of spaces, etc., are being carried rapidly forward and every thing points towards a most successful exhibition and profitable time generally.

A Neat Catalogue.—I am indebted to the Van Depoele Electric Manufacturing Company for a copy of a neat catalogue just issued by them, descriptive of their low tension and high tension arc light systems and the Mayo incandescent system. The cuts are nicely gotten up and the catalogue contains some valuable tables, specially compiled by the company, showing sizes of wire of 100 volt lamps taking .54 ampère each, and giving distances from dynamo at 103 volts. This table will be found specially valuable. Accompanying the catalogue are a large number of facsimile letters endorsing the efficiency of the different systems, and all from parties who have been using the apparatus for at least three years.

Exhaust Heads for Electric Light Plants.—Mr. W. C. Lyman, the inventor and manufacturer of the exhaust head, informs me that his device is being placed in the leading electric light plants throughout the country. Among those recently sold was one No. 14 for the Western Electric Company, New York and Chicago, having previously furnished them with No. 7 and No. 11; also the Chicago Edison Company, Chicago, No. 16; the Troy Electric Light Company, Troy, N. Y.; the City Electric Light Company, Chicago.

Sales of Underwood Belting.—Mr. F. P. Mack, Western agent for the Underwood Manufacturing Company, sends the following report of sales of belting during the past week: 71 feet 30-inch, 57 feet 29-inch, both double cotton leather belts, to the Compound Lumber Company, Hegewisch, Ill. This sale was on the recommendation of the C. C. R. R., to whom the Underwood Manufacturing Company sold 350 feet 48-inch about two years ago, which runs their cable railroad from 39th street to 63d street. Another sale is to Jacob Biedlaw, of this city, of 156½ feet 24-inch, and long belts each of 22-inch, 20-inch, 18-inch, 16-inch, 14-inch, 12-inch, all double cotton leather.

High Insulation.—The Electrical Supply Company have secured the exclusive Western agency of the Cobb Vulcanite Wire Company, of Wilmington, Del. This wire is the result of careful study, and its high insulating qualities have been tested by experts and found, it is claimed, to have the highest insulation with the lowest inductive capacity. The insulation is of hard vulcanized rubber, and the qualities of hard rubber as an insulator are well known. It is claimed that this wire is especially adapted for underground purposes, having overcome the objections heretofore experienced. The hard vulcanized rubber is made under an entirely new process, which renders it strong, durable and very flexible, as recently described and illustrated in your columns. I learn that large orders for the wire have already been placed, and the Electrical Supply Company have shown their usual enterprise in securing the agency.

The Heisler System.—The following interesting notes about the Heisler incandescent system are extracted from a recent article in the *Age of Steel*:

The marvelous growth of the Heisler electric light system is best realized by calculating the amount of capital that has been enlisted in its behalf during the last two years. The Heisler Electric Light Company ($200,000), the St. Louis Illuminating Company ($100,000) and thirty-six central station plants in all parts of the country represent a capital of at least $1,000,000. The great financial success which has attended every one of these enterprises, and the perfection of this system in supplying all possible requirements from one central point, combining successfully the illumination of the streets with the supply of light for commercial and domestic purposes, covering territories of any desired extension, have earned for the system its reputation as a most promising competitor of gas lighting. One of the most important branches is the manufacture of the Heisler incandescent lamps. This is forming a separating department of the factory on Seventh street, and it is stated that the division of labor and control over manufacture by means of automatic regulating devices is so perfect that it has been possible to dispense entirely with skilled labor, a matter of the greatest consequence for the reduction of the running expenses of the light plants.

The building of central stations in all parts of the country—Oregon, Utah, Kansas, Missouri, Indiana, Minnesota, Texas, Arkansas, California, New Jersey, New York (seven large plants in the immediate neighborhood of New York City)—which includes the construction of the electrical apparatus, the steam plant and the lines—has necessitated the keeping of a complete staff of expert electricians. Nearly 200 people are now employed in the various departments of the Heisler Company's works.

The St. Louis Illuminating Company's enterprise represents the first practical application of the Heisler system. It is one of the most extended incandescent plants in the world. The central station is at Second and Gratiot streets and contains a steam plant of 500 h. p. capacity and electrical apparatus of a capacity of about 5,000 lights. The circuits extend over a territory of not less than 12 square miles. The company possesses pole lines along the streets from Fourth to Fourteenth and along Oliver street from Fourth to Grand avenue. The business of the company is conducted on a basis entirely different from that of the Eastern companies with the old systems, as its operation is not confined to the surroundings of the station, extending to wherever there is a call for electric light, irrespective of the distance.

The distribution of candle-power is of any variety from 15 to 200 candle-power, to suit the different requirements of private residences, commercial lighting, halls, clubs, libraries, etc. The progress of the company has been wonderful during the past year in more ways than one.

The retail business of the city is more largely than ever employing the Heisler incandescent light for brilliant displays of goods and merchandise. Then, again, the financial success of this company is something remarkable in the history of electric light companies. It has been on a dividend-paying basis ever since it was supplying the first 400 thirty candle power lights. It is rapidly approaching a point where it will exercise a still larger control of the illuminating interests in St. Louis in regard to commercial and private lighting.

The career of the founder of these enterprises is a remarkable one, and furnishes abundant illustration of what can be accomplished by brains, pluck and enterprise. Charles Heisler, president of the company and managing director of the others, the St. Louis Illuminating Company and the American Carbon Company (whose present interests are the result of his powers of invention and industry), began his career in St. Louis in 1870, and has since done as much, or more, perhaps, to render electric lighting practical and popular than any one else of his time. He is a German, possesses a thorough education and is a mechanical engineer and electrician of repute both at home and abroad. He established himself here in the business of manufacturing hotel annunciators, house bells, burglar alarms, etc., which was a very successful enterprise from the first (1876). When his business had become thoroughly established and had reached important proportions he formed the Heisler Electric Bell and Burglar Alarm Company. Notwithstanding the great and immediate success which Mr. Heisler met in this line, his desire was to arrange and perfect a system of electric lighting, and much of his time was devoted to this object. He at last succeeded, and the value of his discoveries and patents was early demonstrated in St. Louis and other Western cities. So great was the success of this system, and so perfect the results, that in 1882 the Heisler Electric Light Company was incorporated with a paid-up capital of $200,000; and it has been most successful in its development and application of electric light for general illumination. While busily occupied with the manufacture of arc light dynamos and arc light lamps after his own pattern, he realized early the necessity of manufacturing the carbon points for the electric light; and at a time when the manufacture of this article was considered the secret of a few he proceeded to apply a manufacturing process on his own account, and to organize the American Carbon Company

(1879). He succeeded so well in producing great quantities of carbon at cheap cost and of excellent quality, that the product goes out to all parts of the country, three-fourths of it being shipped to New York city. E. L. P.

MILWAUKEE, Wis., Jan. 29, 1889.

Electric Roads.—The statement has been made on excellent authority that the Milwaukee City Railroad Company intends to run its cars by electricity in the near future. It is also expected that a street car lighted and propelled by electricity will shortly be exhibited in Milwaukee. The car is being fitted up now in Detroit with storage batteries manufactured under the Woodward patents, the rights of which for Wisconsin and Upper Michigan have been secured by the Wisconsin Storage Battery Company, a Milwaukee corporation. The capital stock of the company is $50,000, divided into 10,000 shares of $5 each. The officers are as follows: President, H. H. Stafford; vice-president, A. G. Weissert; treasurer, DeWitt Davis; secretary, H. T. West.

The First Electric Crane ever built in the United States has just been introduced in the foundry of E. P. Allis & Co. It is a ponderous affair, weighing thirty tons, and is capable of lifting and carrying to any part of the fouudry, with ease, a weight of twenty-five tons. The crane is a bridge-like affair, suspended on tracks built on each side of the foundry near the ceiling. It is provided with three Sprague motors. One moves the crane from one end of the foundry to the other, another moves the carriage with which the crane is provided from one side of the foundry to the other, and the other runs the lifting machinery. Its advantage over the ordinary power traveling crane, which it resembles somewhat, is a saving of power and the wear and tear of machinery. The crane is the invention of A. J. Shaw, designer with E. P. Allis & Co., who has applied for a patent.

COLORADO SPRINGS, Col., Jan. 30, 1889.

The El Paso Electric Light Company, of this place (Colorado Springs), have a capacity of about 2,100 incandescent and 100 arc lights, and are now figuring on a considerable increase, as they are overcrowded.

The Manitou plant has a capacity of 1,000 incandescent and 30 arc lights, but at present is running only about three hundred and fifty of the former and twenty of the latter. The company expect to run up to full capacity during the summer. For some reason they have abandoned their very expensive and apparently efficient water power.

Mr. Wm. Long, electrician for the Iron Springs Company, of Manitou, has designed an arc lamp, which for mechanical simplicity and practical efficiency, promises to equal or surpass anything in the market. The patent has not been issued yet. W. C.

LA CROSSE, Wis., Jan. 31, 1889.

The La Cros e Edison Company started the 24th day of August, 1887, with 1,600 ten c. p. lamps, and to-day they have 7,500 ten c. p. lamps connected to their system. They use the meter altogether in private residences, and are supplying some lights by the contract system. They are also supplying the current for eight electric motors operating printing presses, etc. The light is giving very good satisfaction. They have coal gas to compete with at $1.50 per M. The station is run by steam power, and is operated 24 hours per day. They claim to have the best lighted theatre in the State, and their regulating devices and arrangement of switches are the best I have ever seen, and I have visited most all the Opera Houses in Chicago. The building is wired throughout with Okonite wire, and all the changing lights, such as the border and foot lights, are wired two in series between the two outside wires of the three-wire system. The work of wiring was done by W. W. Morgan, the electrician, under the supervision of Wm. D. Kurz.

CANADIAN NOTES.

FREDERICTON, N. B., Jan. 31, 1889.

The Telephone Deal.—A special meeting of the shareholders of the Nova Scotia Telephone Company was held in the Halifax Hotel, Halifax, N. S., on Jan. 23, to ratify an agreement to sell the rights, good-will and property of the Nova Scotia Company in the Province of New Brunswick to the Bell Telephone Company, of Canada, for transfer to the New Brunswick Telephone Company. The meeting ratified the sale. The price is $50,000. The Nova Scotia Telephone Company also formed a quadruple combination with the Bell Telephone Company, of Canada, the American Bell Telephone Company of the United States, and the New Brunswick Telephone Company, whereby all these corporations agree to connect their systems one with another, to work together and to allow no other company or companies or opposition lines to connect with any of their lines. It is understood the Nova Scotia Telephone Company has declared a dividend for the year of 6 per cent., payable the 1st of February.

The New Brunswick system will comprise five exchanges, including St. John, besides the trunk lines connecting them.

ENGLISH NOTES.

LONDON, Jan. 16, 1889.

The Gaulard-Gibbs Appeal.—The appeal of Messrs. Gaulard and Gibbs against the judgment of Mr. Justice Kekewich invalidating their transformer patents, came on for hearing on the 12th inst., and has occupied the attention of Appeal Court II. ever since, almost without intermission. By all appearances the case is likely to drag on for as long again.

Mr. Norman Lockyer on the Aurora Borealis.—At the Royal Society last week Mr. Norman Lockyer read a paper on the spectra of the aurora borealis and of the lightning flash. He attributes the aurora to minute particles of dust floating in the highest regions of the atmosphere, which dust he supposes to be produced by the fall of meteors. His paper was illustrated by references to observations on the spectra of gases in vacuum tubes by Wiedeman, Hasselburg, Prof. Franklin and others.

The Edmunds Distributors.—I am afraid that in my letter to you of November 28, which appeared in THE ELECTRICAL WORLD of December 29, I gave a somewhat too unfavorable account of Mr. Henry Edmunds' system of electrical distribution. Since that date, Mr. Edmunds has introduced several important improvements in the principal feature of his system, viz., the automatic distributor, and the cost of this apparatus is very materially reduced. The improvements consist chiefly in the simplification of the mechanism and an arrangement which prevents the batteries from being by any chance disconnected from the lamps.

Extension of the Electric Light in the House of Commons.—An extension of the electric light is in progress at the House of Commons. Hitherto the only portions of the building illuminated by electricity have been the division lobbies and upper corridors, the library, reading room, tea-room, smoking-room, and a limited number of other apartments. When the House reassembles, however, the members will find gas superseded in the cloak-rooms' entrance lobbies and main staircase. It is to be hoped that this is the first step toward the general adoption of the electric light in our Houses of Parliament, and that before long the oil lamps still used in many parts of the building will be abolished.

The Electric Light in Our Dock Yards.—The electric light continues to make great strides in our naval yards. At Portsmouth, for instance, there are now 96 electricians employed, where a few years ago one man and a boy sufficed to do the work; and within the next three months it is expected that this number will be increased to 250 hands. The dock yard authorities intend in future to undertake a far larger proportion of the electrical work connected with our ships of war than has hitherto been the case. The electric light has also proved invaluable when ships are in course of construction, and in the examination of ships' bottoms, the inspection of which was in the old days necessarily a somewhat perfunctory business, owing to the impossibility of obtaining sufficient light.

Electricity and Refuse.—The local authorities in this country are endeavoring to find some means of utilizing the parish refuse, and the idea has occurred to some towns, among others to Derby, that perhaps the problem of obtaining the electric light at the price of gas might find its solution in refuse. At Derby there is already in use a "refuse destructor" consuming about 150 tons of combustible material every week. Assuming that 1 pound of this refuse is only equal to ½ pound of coal, there is still a weekly supply of fuel equivalent to 112,000 pounds of coal, capable of producing 37,000 horse-power hours, or 220 h. p. continually at work. If, however, power is only required for 12 hours per day, no less than 440 h. p., would be available, sufficient to supply on a moderate estimate 3,000 incandescent lamps. It would seem, therefore, that in Derby, at any rate, the whole of the municipal buildings could be lit by electricity at a comparatively low cost.

The Telephone at the Stock Exchange.—The first days of the new year witnessed the introduction of the telephone into the London Stock Exchange, and the system has so far given great satisfaction. At one of the doors of the "house" twelve sound-proof boxes have been erected, in which the telephone instruments have been put up. The *modus operandi* is somewhat cumbersome, but it is necessary and works well. When a member desires to speak from his office to any one in the "house" he calls up the Stock Exchange and mentions whom he wishes to speak to. The waiter in charge of the telephone room has speaking tubes to all the different doors of the Stock Exchange. When any one is called for over the telephone the waiter speaks to the man in charge at the proper door, who summons the member in the usual way, with the addition of a sign which is to be recognized to mean "telephone." The member called goes to the call office and that is all.

Cable Investments.—The German Government having purchased the cables belonging to the German Union Telegraph and Trust Company, the concern will shortly be wound up. This means that over £700,000 will be set free for investment, and as it is highly probable that the majority of the shareholders will put their money into property of a similar character, it may not be without interest to call attention to the shares of two cable companies, which may be purchased to give a return equal to that lately enjoyed by the German Trust Company, namely, 6 per cent.: The West Coast of America Company, with a capital of £300,000 in £10 shares, paid a dividend of 5 per cent. in 1887, and from the traffic returns to hand a still better dividend may be expected for 1888; as the £10 shares can be bought for £9 and under, a return of 6¼ per cent. is possible. The Western & Brazilian Company paid a 4¼ per cent. dividend in 1887, and the dividend for 1888 will probably amount to at least 5 per cent., and at the present price of the shares, an investor obtains 6 per cent. for his money.

Electric Sugar.—The bursting of the "electric sugar" bubble has given rise to considerable comment in the daily press in this country, some of the papers going so far as to assert that the "bona fides" of the process remained unquestioned to the last. In face of the protests of the technical journals, and of the letter of warning addressed to the *Times* by Prof. Sylvanus Thompson, in October last, this is, to say the least, an overstatement. However, if people in this nineteenth century still prefer to put their faith in secret processes, strong rooms and similar paraphernalia rather than in simple five per cent., there is really nothing more to be said in the matter. The unsuspecting Mr. Robert Roberts, one of the largest English shareholders in the Electric Sugar Refining Company, is, I hear, a "Christadelphian," a sect who see the fulfillment of some old prophecy in every scientific invention. The electric dog-cart recently sent out to the Sultan by Messrs. Immish & Co. was said to have been foretold in the vision of Ezekiel. I trust Mr. Roberts will be consoled for the loss of his money by the discovery that the electric sugar fraud was plainly foreshadowed in the Book of Daniel.

A Subway Railway for London.—A scheme will shortly come before Parliament, which, if it survives the threatened opposition of the Oxford street and Holborn shopkeepers and the usual vicissitudes of all demands for parliamentary powers, may possibly prove London's solution of the municipal rapid transit problem. Powers are sought to run a railway subway under the streets from Piccadilly Circus to Holburn Circus, a distance of about 1¾ miles. If these modest demands are granted, it is proposed to extend the line eastwards into the heart of the city and westwards towards Kensington, and later on cross lines will be constructed. The tunnel will extend across the roadway from curb to curb, the concrete floor being only 12 ft. from the street level. Iron columns 4 ft. apart will form the retaining walls, the spaces between the columns being filled in with "ferfiax," which is said to be a tough fibrous material compressed by hydraulic power. It is proposed to have four distinct tracks, and galleries for steam, pneumatic, hydraulic, gas and water pipes, as well as conduits for electric light cables. It is needless to say that electricity is to be the motive power. A railway of this nature is certainly much wanted in the metropolis, since the present underground railway only skirts round the fringe of the business portion of London and tramways are rigorously excluded; so that we are obliged to rely upon the omnibus for all purposes of rapid transit in the centre of the metropolis.

Telephonic Extension.—One of the most satisfactory features of recent telephonic development in this country is the rapid increase of our trunk lines. Up in the North, inter-urban telephonic communication has been brought to a high degree of perfection and most of our large manufacturing towns are now well provided with trunk wires. Even the South and the West are waking up, and before long we may expect to see the whole of England covered by a network of inter-urban lines. The main trunk line between London and Birmingham is more than half finished, and the ground is being surveyed for the erection of a line telephonically connecting the metropolis with Bristol and South Wales. Our largest provincial company, the National Telephone Company, has perhaps been the most energetic in this respect, but the other companies have followed closely in its steps. The Lancashire and Cheshire Telephone Exchange Company, with a total mileage of 8,930 miles, possesses 2,560 miles of trunk wires, or 29 per cent. of the total. Again, the enterprising Northern District Telephone Company, with a mileage of only 2,600, has no less than 1,430 miles of trunk lines that is to say, 54 per cent. of the total. The revenues of our three largest companies, the United, National, and Cheshire, for this year is estimated at no less than £250,000. In short, our telephone development forms a pleasant contrast to our backwardness in other branches of electrical enterprise.

THE TELEGRAPH.

Lebanon, Pa., will put in a fire alarm telegraph system.

Anniston, Ala.—The Mayor is proposing to contract for a fire alarm service for the city.

Savannah, Ga.—The Savannah Electrical Company have organized with Mr. P. W. Meldrum as president, and will proceed at once to undertake burglar alarm and telegraph work.

Oregon.—The Drain and West Coast Telegraph Company has been incorporated by W. F. Perkins, J. Lyons, R. L. Shelby, W. Keykendall and C. D. Drain, with a capital stock of $20,000, to build a telegraph line from Drain to Gardiner.

The Mistletoe Wire.—A telegraph wire is the last thing one would expect to support vegetation, yet a traveler in Brazil writes to a German horticultural journal describing a crop of mistletoe which he found clothing the wires not far from Rio Janeiro.

The "International" Cable.—A special dispatch of Feb. 2, from London, says: In the matter of the scheme for an "international cable line," which was recently made public, extending from Nova Scotia and touching the islands in the Atlantic, the following information is derived from trustworthy business sources: So far as we have learned, the International Cable Company's capital has never been subscribed, nor have they carried out any agreements, except for the laying of a mile or two of shore end cable, to avoid losing the Portuguese government's concession. There is no further cable manufactured or being manufactured, neither is there any possibility of getting money to carry out the prospectus referred to. The Sir William Armstrong mentioned as being connected with the scheme is not at all connected with telegraphy, and is not Lord, formerly Sir William, Armstrong, of gunmaking fame.

THE TELEPHONE.

Johnson City, Tenn.—Mr. M. I. Gump, secretary of the Johnson City Electric Light and Power Company, wants to put in a long distance telephone line of 40 miles, and is in the market for materials.

The American Bell Telephone Company has filed notice of a desire to increase its capital stock. The present stockholders will get rights to subscribe for the new stock, the amount of which is not stated, but which is either $10,000,000 or $20,000,000.

War on Telephone Poles.—The New Jersey Telephone Company has obtained an injunction from the Supreme Court restraining Henry Winters, a belligerent property owner of Plainfield, N. J., from again interfering with their poles. Winters had men on hand to cut down the poles, but they were cowed into submission when informed that they would be at once arrested if they meddled with the poles, which a second time were then erected on Winters' premises. It is expected that his lawyer will take some other action to get them removed.

Missouri & Kansas.—The stockholders of the Missouri & Kansas Telephone Company held their annual election of officers in Kansas City on Jan. 25, and elected the following board of directors: John E. Hudson, Boston; George L. Phillips, Chicago; J. R. Mulvane, Topeka; W. B. Clarke, J. S. Chick, C. D. Crandall, Kansas City; J. T. Lane, Davenport, Ia.; T. B. Sweet, Topeka; and S. A. Walker, St. Joseph. The annual report of President Mulvane was read and showed that the gross earnings for the year amounted to $391,507.41, and the gross expenses to $316,894.85, making the net earnings $77,612.56. The new board held a meeting and re-elected the old officers.

THE ELECTRIC LIGHT.

Ligonier, Ind., wishes to put in an electric light plant.

Pennacook, N. H., is anxious to get an electric light plant.

Monticello, Ind.—A new electric light plant is under consideration.

Rock Hill, S. C.—The standard cotton mills are putting in an electric light plant.

Lowell, Mass., is to have a local Edison company, with a capital stock of $100,000.

Goldsboro, N. C.—Mr. O. H. Foster, of Raleigh, has asked for an electric light franchise.

North Attleboro, Mass.—The local electric light company has declared a 6 per cent. dividend.

Nashville, Tenn.—The plant which the city proposes to put in is to be erected at the water-works.

Laconia, N. H.—The Laconia Electric Light Company has voted to increase its capital stock to $50,000.

Princeton, Ky.—The Commercial Club of Princeton inquires as to the cost of plant for 25 arc lights.

Winchester, Va.—Mr. G. W. Kurtz will receive proposals for an electric light plant for city lighting, etc.

Roanoke, Va.—An incandescent plant is proposed by H. L. Maynard and J. L. Watson, of Portsmouth.

Brooklyn, N. Y.—The Brooklyn Edison Company has increased its capital stock from $500,000 to $600,000.

A 5,000 Light Generator is now, it is said, being built at Pittsburgh by the Westinghouse Electric Company.

St. Joseph, Mo.—The Globe Electric Light and Power Company has been incorporated with a capital stock of $25,000.

Amite City, La.—The Gullett Gin Company are putting a Westinghouse incandescent plant in their gin factory.

Sherman, Tex.—The Sherman Electric Light and Power Company proposes, it is said, to go into incandescent lighting.

Lowville, N. Y.—The Lowville Electric Light Company is to put in a 650-light incandescent dynamo as soon as possible.

Marietta, Ga.—Mr. T. W. Glover and others propose to put in an electric light plant, and are now investigating the subject.

Orange, N. J.—The electric lighting plant of the Excelsior Company was transferred last week to the Essex Electric Company.

Havana, Cuba.—The Westinghouse Electric Company recently made a shipment to Havana, Cuba, of over 12,000 incandescent lamps.

New Ulm, Minn.—The New Ulm Electric Light Company has been incorporated by Mr. Mullen and others, with a capital stock of $25,000.

Cedartown, Ga.—The Empire Water, Light and Manufacturing Company has been incorporated by C. P. Ball, J. H. Meed and oth-

ers, with a capital stock of $100,000. It will put in an electric light plant.

Wytheville, Va., will probably put in an electric light plant this summer, and Mr. C. W. Gleaves should be addressed on the subject.

The Advance Electric Company, of New York, has been incorporated by A. King, S. Bell and T. Larbig, with a capital stock of $50,000.

Milwaukee, Wis.—A bill has been presented in the Wisconsin Legislature authorizing Milwaukee to raise $25,000 for an electric light plant.

St. Louis, Mo.—Bids will be received by C. H. Fuller, of the Board of Public Works, for an electric light plant in the Polytechnic building.

Baltimore, Md.—The Waterhouse Company, of Baltimore, have ordered four 50 h. p. engines from the Valley Iron Works, of Williamsport, Pa.

Underwriters' Wire, whether for outdoor or indoor use, has been placed under absolute ban of prohibition by the Boston Fire Underwriters Union.

Birmingham, Ala.—Mr. T. Jeffers has been elected president of the new Merchants' Electric Light and Power Company. The plant will be put in at once.

Victoria, Tex.—The movement for electric lights has been successful and a company with a capital stock of $25,000 has organized. Plant will be bought at once.

The Troy Electric Dynamo Company, of Troy, N. Y., has been incorporated with a capital stock of $20,000 by Justus Miller, W. L. Hall and C. E. Hartwell.

Easton, Md.—The Easton Gas Light Company will hold a meeting on Feb. 26, to consider changing the name of the company and adding an electric light plant.

Baltimore, Md.—Proposals for lighting the new post office will be received by Secretary Fairchild, as announced by advertisement in our columns, until February 25.

Mount Sterling, Ky.—Mr. T. H. Tearey is organizing a local Thomson-Houston Company, and the city council may decide to help in the work on behalf of the city.

The Potter-Compton Electric Light Company, of Toronto, Can., has been incorporated, with a capital stock of $50,000, to float a primary battery for lighting purposes.

Marion, Ala.—President S. W. Averett, of the new Judson Institute, at Marion, states that in spite of reports to the contrary he does not think they will put in a plant for the Institute.

Seattle, W. T., is forming a co-operative electric light company, with a capital stock of $50,000. The committee on organization consists of G. B. Adair, J. D. Lowman and G. H. Heilbron.

New York City.—The Excelsior Electric Light, Heat and Power Company, of New York, has been formed by M. M. Belding, C. W. Darling, J. R. Emery and F. P. Slade, with a capital stock of $10,000.

Monroe, Mich., a city with a population of 5,700, invites proposals for street lighting, with 50 arc lights. Mr. George R. Hurd is Mayor. The terms of contract will be found in our advertising columns.

Great Falls, N. H.—The local electric light company is putting in a plant at the "New Dam" to furnish current for Great Falls, Dover, Gonic, Rochester, East Rochester, Salmon Falls and South Berwick.

The Marr Construction Company, Pittsburgh, have received a large contract for lighting the streets of a town in the interior of Brazil, South America. The contract calls for 1,500 lights of 32 candle-power.

The United States Electric Light Company has just contracted for a plant to be placed in the new building of the Girard Insurance Company at Broad and Chestnut street. Over 600 lights will be distributed through the building.

North Brookfield, Mass.—The North Brookfield Electric Company has been organized with a capital stock $15,000. The officers are: F. Batchelder, president, and B. H. Smith, treasurer, who are directors with T. T. Robinson and C. A. Bowditch.

California.—The Brush Electric Company, of Cleveland, have recently received another order from the California Electric Light Company for a new plant consisting of a 60 to 65 light arc machine, with lamps, etc., this plant to be used on the Pacific Coast.

Council Bluffs, Ia.—The Council Bluffs Electric Light Company will erect a large brick building adjoining the present plant. The building will contain dynamos for the incandescent system the company proposes to erect here within the next sixty days.

Carbons.—The carbon business of the Brush Electric Company has grown to enormous proportions. Over half a million carbons are occasionally shipped from the Cleveland factory in a single day. This takes no account of the business done from the various branch offices.

The Century Electric Company has been incorporated in New Jersey by T. G. Brown, C. S. Stockton, W. A. Brown, C. G. Kubler, of Newark, and T. B. Brown, of New York, with a capital stock of $100,000. It will manufacture electric light and power apparatus at Newark.

Clinton, Wis.—The Vandepoele Electric Manufacturing Company, of Chicago, has closed a contract with the Village Board to light the streets by electricity. Incandescent lights, to the number of 125, have been engaged for stores and dwellings. The plant will be operated by A. Woodward.

In Favor of the Subway Board.—Judge Beach, in Supreme Court, Special Term, New York City, before whom the suit of the United States Illuminating Company against the Board of Electrical Control was brought for trial, at the conclusion of the plaintiff's testimony dismissed the complaint.

California.—W. C. Clark has sold a 500-light alternating incandescent Westinghouse plant to the Haywards Electric Light Company. Also a Westinghouse compound engine. A 3,000-light Westinghouse plant has also been sold recently to the Willamette Falls Electric Light Company, of Portland, Or.—*Pacific Lumberman.*

Quincy, Mass.—The Quincy Electric Light Company having secured the desired increase in capital, which is now $60,000, has contracted for increased machinery, including one Armington & Sims engine of 150 h. p., which will double the present capacity of its works; also a Cunningham steel boiler of 125 h. p., with Jarvis setting.

St. Albans, Vt.—The St. Albans, Vt., Electric Light and Power Company has elected these directors: T. S. Miller, A. A. Hall, J. M. Foss, D. D. Ranlett, L. J. Wing, W. T. Smith and M. Magiff. Mr. T. S. Miller is president, A. A. Hall vice-president, W. H. Chaffee secretary and treasurer, W. T. Smith manager. The company is now running over eighty arc lights and some incandescents.

Lincoln, Neb.—Two boilers in the engine-room of the State Hospital for the Insane at Lincoln, Neb., exploded last week, wrecking the engine-house, killing two patients and injuring two patients and the two engineers, who will probably die. The explosion completely destroyed the five boilers and the dynamo for furnishing electric light, leaving the building without heat or means of preparing food. Loss, $20,000.

Steamer Lighting.—The contract for lighting the new steamer now under construction for the Detroit and Cleveland Steam Navigation Company has been awarded to the Brush Electric Company. This new steamer will be the handsomest one afloat on the Lakes, surpassing in size and elegance even the last one built for the above company (the "City of Cleveland") a few years since, which is also lighted by the Brush system.

Infringement Suit.—The suit of N. S. Keith against the Pacific Coast Electrical Construction Company for infringement of patents has been decided by Judge Sawyer in the United Stated States District Court, San Francisco, in favor of the plaintiff, and the matter was referred to S. C. Houghton, Master in Chancery, who will assess the amount of damages due to Keith. The Construction Company has gone out of business, but former stockholders are liable.

Council Grove, Kan.—While many of our neighboring cities are going back to the era of darkness, the electric lights of this city illuminate the scene nightly, with the same beautiful effulgence. Council Grove's electric light system is founded on the solid rock; it is owned by the city, and more arc lights are in use than in any other city of 3,500 inhabitants in the State. The dynamo is run to its full capacity, and in order to secure more lights another dynamo will be required.—*Republican.*

Canon City, Col.—The Canon Thomson-Houston Electric Company, which was shut down recently, owing to an accident in its power plant, is desirous of reorganizing, and of adding incandescent apparatus to its arc, as well as putting in the necessary steam equipment. Canon City is a growing town, and there is a demand for light. It is claimed that a thoroughly equipped plant will make money, as there is no competition except that of oil lamps. Dr. F. P. Blake is president and manager of the company, and Mr. S. A. Dewey is secretary and treasurer.

St. Louis, Mo.—The St. Louis Electric Light and Power Company has purchased a valuable piece of ground on Twenty-first street and Lucas Place (Locust street), and will erect thereon a large central lighting and power station. The Missouri Electric Light and Power Company also propose to erect a central station, and for this purpose have purchased 170 feet front on the southeast corner of Twentieth and Lucas place (Locust street). They will put in a 400 h. p. steam plant at that location, it is rumored. The company is also arranging for extensive wiring throughout the city.

Bridgeton, N. J.—The Ferracute Machine Company have just put in a Van Depoele incandescent plant, including a Mayo dynamo for 125 lights. They use 95 lamps of 16 c. p. in the shops and offices, and four 50 c. p. lamps for the yards. The plant is very satisfactory and requires only 10 h. p. for the 99 lamps. The extra cost for coal is 10 cents an hour, or 20 cents a day, at this season for the whole number, or about one-tenth the cost of street gas. The total cost of the outfit was about $1,000. The company "find the incandescent system a very desirable one for lighting our machine shops, offices, etc., and would recommend it to any one wanting a first-class lighting plant."

Edison Litigations.—The Consolidated Electric Light Company has filed its answer in the United States Circuit Court, in the suit brought against it by the Edison Electric Light Company for infringement of patents. It denies that Mr. Edison was the inventor of the improvements in incandescent electric lamps specified in the complaint, and claims that the Sawyer-Man patents held priority. It is also alleged that a grant was made by the Edison Electric Light Company to other parties of the right to manufacture and sell the lamps prior to the filing of the complaint, and that the people receiving the grant were necessary parties to the suit.

A Curious Question.—That is a curious question raised before the Dauphin County Court, whether electric lights are manufactured articles. If they are it is contended that the companies furnishing them are exempt from State taxation as manufacturing corporations. Whatever may be said about lightning, there is no doubt that all electric lights produced by man result either from combustion or incandescence. If he does not manufacture the electricity that produces the combustion or incandescence he at least releases it, sets the force in motion, guides and controls it, that it may be made useful in work. The gaslight is just as natural as the electric light; neither exists in the form in which it is used by man until the power that produces it is made or released by artificial means.—*Philadelphia Ledger.*

Going to the Convention.—Applications for berth checks for the special "Electric Express" to the Chicago Convention will be received at this office, and forwarded to Mr. Porter, chairman of the Committee on Transportation. If a sufficient number of delegates is secured from this city and New York, the Pennsylvania Railroad Company will furnish a special vestibule train consisting of baggage car, dining car, combination smoking car and three sleepers for their transportation without extra charge other than the regular berth fare. This train will leave New York at 9:45 on the morning of Sunday, it is proposed, arriving at Chicago at 9 o'clock the following morning. This run, which will be made in 23¼ hours, is three-quarters of an hour faster than the limited express schedule. Mr. Porter is hopeful that every person desiring to go on this train will send his name and sleeping car fare, $5, either to this office or to Mr. Porter within one week, so that the berths may be apportioned and the train be secured. The advantages of Mr. Porter's arrangement with the Pennsylvania Railroad cannot be overestimated.

APPLICATIONS OF POWER.

Edgewater, S. I., is reported to consider favorably the subject of electric railways.

Kearney, Neb., is to have a large new paper mill operated by 100 h. p. of electric motors.

The Mystic Electric Motor Company has been organized at Portland, Me., with $100,000 capital.

Lynn, Mass.—The electric road in the Thomson-Houston factory for handling freight, etc., is in operation.

Roanoke, Va., favors the Sprague system, represented by Mr. R. Smith, for one of its street railways about to be built.

Knoxville, Tenn.—A local company has been formed to build an electric road to Lyon's View and will secure right of way.

Sacramento, Cal.—Mr. L. L. Lewis has ordered five more storage cars, using the Electrical Accumulator Company's battery.

Chattanooga, Tenn.—The bid of $30,000 from the Gaynor Electric Company, of Louisville, Ky., for the new electric road, has been accepted.

Fort Worth, Tex.—The North Side Street Railway Company will operate its 10¼ miles of new road by electricity, putting in two 75 h. p. engines, building power house, and spending about $60,000 on the equipment, etc.

Springfield, Mo.—Mr. E. J. Lawless, manager of the proposed electric railway at Springfield, says that he will have the cars moving on the 4th of July.

Seattle, W. T.—Plant is now being delivered for the road of the Seattle Electric Railway and Power Company, and the poles are up. Cars are to be running in March.

Topeka, Kan.—The St. Louis Car Company is now delivering at Topeka the new cars for the rapid transit electric road, and they will be running by Feb. 15. Each car seats 22 persons, but will of course accommodate at least three times as many passengers.

Plainfield, N. J.—The Plainfield, N. J., Common Council has decided to grant to Mr. Leo Daft the exclusive franchise for a street railroad in the city, and he will at once begin to build a street-car line to be operated by electricity on the storage-battery system.

The Paris Exhibition.—The railway which is to run from one end to the other of the Paris Exhibition of this year will be, in itself, a most interesting exhibit, for the hundred carriages are to be made upon different models, and the fifteen engines will be worked by steam, compressed air and electric motor.

Pennsylvania.—It is reported that the syndicate of capitalists who have purchased the Allentown passenger railroad franchise will construct an electric railway from that city to Bethlehem. It is also stated that a similar line will be built from Allentown to Catasauqua. Pittston, Pa., will have a six-mile electric railway.

Ashland, Ky.—The Ashland & Catlettsburg Street Railway Company, recently reported as to be organized soon to build a street railroad from Ashland to Catlettsburg, will build an electric railroad. They will secure power from the Ashland Electric Light and Power Company, which is to increase its plant, and has already decided to put in capacity for 500 16 c. p. lamps.

Brunswick, Me.—A bill has been introduced in the Maine Legislature to incorporate the Brunswick Electric Railway Company. The incorporators are Charles P. Storey, F. H. Wilson, J. P. Winchell, G. E. Woodbury and Frank C. Webb, who are empowered to construct a railroad to be operated by steam, animals or electricity, in Brunswick, Harpswell and Topsham.

Wichita, Kan.—On one of the Thomson-Houston motors in use on the electric railway, a copper brush was in continuous use for 65 days, during which time the car covered a distance of 4,300 miles. This is without question, it is claimed, the longest time that a motor brush has been in continuous use, and speaks the highest praise for the one which is used by the Thomson-Houston Company.

Nebraska Electric Light and Motor Company.—Mr. C. D. Covell, the manager of the newly-organized Nebraska Electric Light and Motor Company, has just returned to Omaha from Boston, where he has completed arrangements for beginning work in Omaha. When in running order, the works will give employment to about one hundred men. The business will be the manufacture of individual electric light plants and storage batteries for the running of street motors. An exhibition will be given in a week or so.

PERSONALS.

Mr. T. A. Edison will, it is reported, visit Europe with his wife this summer.

Mr. S. A. Duncan, president of the National Electric Light Association, was in New York last week.

Mr. G. H. Condict, electrician of the Electric Car Company of America, of Philadelphia, was a visitor in New York during the past week.

Mr. C. E. Hart, representing the Thomson-Houston lighting system, has lately put in a plant at Richmond, Mo., and is closing the sale of another plant at Trenton, Mo.

Mr. J. N. Gamewell, of the Gamewell Fire Alarm Telegraph Company, has sustained a heavy loss in the death of his wife, whose charities and benefactions are widely known.

Mr. F. W. Bosson, of the Thomson-Houston staff of engineers, at Chicago, has been entrusted by Mr. Sunny with the work of arranging the exhibits at the forthcoming electric light convention.

Mr. D. C. Sprague, of the Sprague Electric Railway and Motor Company, left this port on February 6 on a business trip to Europe, and thence to South America. He expects to be absent one or two years.

Mr. Norman McCarty, lately associated with the Baxter Motor Company in the allotment of territory, etc., has joined the forces of the railroad department of the Thomson-Houston Electric Company.

Mr. A. R. Foote, of Cincinnati, has been recently in the East studying the electrical situation and investigating more particularly the relations of municipalities to the control of the new electric agency for light and power.

Mr. George W. Davenport, of Boston, so well known in the management of the Thomson-Houston system, was married on February 2, to Miss L. Park, of Charlestown, Mass., and is receiving the congratulations of a wide circle of friends.

Col. W. W. Smith, general manager of the Bell Telephone Company, is in the city. Colonel Smith has resided in Kansas City for a number of years, and has a large circle of acquaintances in this city. Ordinarily he is a very quiet man, but when in the notion he is one of the most interesting talkers who visit the capital. With perhaps one exception he is the oldest telegraph operator in the world. He is the author of many of the most intricate and brain-puzzling keys for secret telegraphing now in existence. Occasionally he amuses his friends by explaining some of the secret methods used during the war. There are few more companionable men than Colonel Smith.—*Jefferson City, Mo., Tribune.*

MISCELLANEOUS NOTES.

San Francisco is forming an electrical society, which will start with nearly one hundred members.

The Okonite Company, New York, will be represented at the Chicago convention by Messrs. W. L. Candee and George T. Manson.

Behind the Times.—It is reported that one of the electricians of Wallingford, Conn., has been working for some time past upon a process of refining sugar, and has succeeded in attaining some wonderful results.

Ka-Ko-Ko.—The Jackson Company, of Nashua, N. H., has a lawsuit in the courts at Manchester, Eng., to establish its rights to an export trademark. The phonograph has been used in the case

to repeat the sound of an owl, representing the mark and exclamation, "Ka-ko-ko."

A Westinghouse Engineering Society.—The engineers of the associated Westinghouse interests in Pittsburgh, Pa., have organized themselves into a society for the purpose of studying electrical and steam engineering. Mr. L. W. Robinson, of the Westinghouse Electric Company, has been elected President.

An Instruction Car has been built at Altoona for Geo. Westinghouse, Jr., which is designed to exhibit to railroad men the practical workings of all the Westinghouse appliances, consisting of working models of the latest improved air-brake for passenger and freight cars, the new friction buffer air signal, steam heating apparatus, electric lighting, and in fact everything pertaining to the mechanical equipment. A 15 h. p. boiler will supply steam to a Westinghouse engine which will operate a dynamo, while a tank with a capacity of 6,000 pounds will carry a supply of water under the car. —*Eng. News.*

The Union Switch and Signal Company.—At a meeting of the Directors of the Union Switch and Signal Company, of Pittsburgh, just held, it was decided to declare a 6 per cent. dividend on the preferred stock of the company. The company have a capital stock of $1,500,000, of which amount $500,000 is preferred stock. The latter is entitled to a dividend of 6 per cent. before the common stock receives any; and it is also entitled to a further dividend of one-half of 1 per cent. for each 1 per cent. paid on the common stock until all the stock receives 12 per cent. The total amount of profits of the company during the last year amounted to $80,000, of which sum $30,000 was used to reduce the company's indebtedness.

The Dallas Electrical Society.—The Dallas Electrical Society met on Jan. 31 at the office of Clower & Harris, and perfected successful organization by electing the following officers: President, J. M. Oram, first vice-president, R. K. Saunders; second vice-president, E. K. Baker; secretary, C. O. Harris; treasurer, Henry Garrett; librarian, H. M. Sutton. Executive committee: Owen J. Cooke, H. C. Wineland, James Schoolfield, W. P. Davis, D. M. Clower, Dr. Andruss, Henry Garrett, W. T. M. Mottram, J. M. Young, E. W. Naylor. House and entertainment committee: W. T. M. Mottram, R. K. Saunders, Prof. C. McCormick, T. G. O'Reilly, E. W. Naylor. Membership committee: D. M. Clower, F. M. Henshaw, E. W. Naylor, Henry Garrett, H. C. Wineland. The society will occupy the Knights of Pythias Hall, the first meeting to be held on the night of Feb. 13. The society is meeting with great success.

BUSINESS NOTICES.

Patterson, Jordan & Gottfried, 146-150 Centre street carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

The Reliance Gauge Company. of Cleveland, O., will have quite a complete display of their Reliance safety water columns at Chicago next week, and the many readers of THE ELECTRICAL WORLD who have manifested an interest in these safeguards will be given an opportunity to investigate their merits, as the columns will be exhibited in operation.

The New York Belting and Packing Company, 15 Park Row, New York, manufacture a large line of vulcanized rubber specialties, all of which are very popular. The special vulcanized rubber belting with smooth metallic surface for electric lighting stations, lately introduced by the company, is an immense success.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED FEBRUARY 5, 1889.

397,109. Switch and Cut-Out for Electric Lights and other Electrical Devices; O. S. Bussmann, Somerville, Mass., Assignor to the Bernstein Electric Light Manufacturing Company, of Portland, Maine. Application filed Oct. 12, 1887. In an incandescent lamp the filament and support combined with the cut-out switch for the filament, comprising conducting portions and a material of comparatively high resistance, which serves as a shunt of high resistance for the filament, but through which the current may pass should the filament be broken or otherwise destroyed, thereby at all times maintaining the continuity of the circuit in which the lamp is placed.

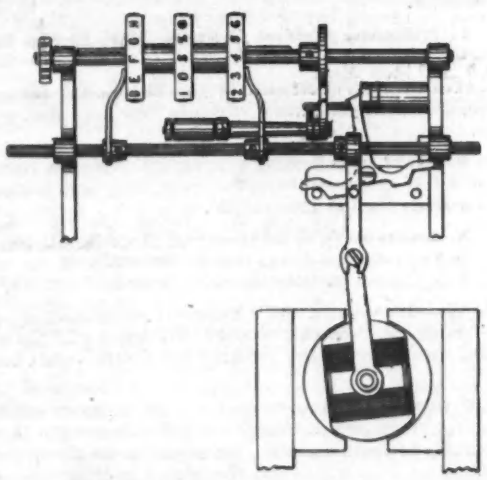
397,111. Galvanic Battery; Edward J. Colby, Chicago, Ill. Application filed May 21, 1888. A square jar with a continuous carbon plate along each inner side and a zinc in the centre.

397,116. Galvanic Battery; C. E. Egan, of Columbus, O., Assignor of one-fortieth to John D. H. McKinley, of same place. Application filed July 9, 1888. A galvanic battery having a trough divided into cells by transverse partitions, a metallic lining in each cell, a cover common to the cells, and positive electrodes secured to the cover.

397,171. Hose Pipe; Edward H. Crosby, Boston, Mass. Application filed Nov. 1, 1888. A hose pipe or nozzle and a support or bracket secured to it, combined with an electric generator held by said support.

397,176. Telephone or Analogous Electric System; A. B. Ferdinand, Oshkosh, Wis. Application filed Oct. 8, 1888. Supplemental generators are adapted to be electrically connected to the main line for generating stronger currents than those which operate the instrument. Electro-magnets are operated by the currents from the supplemental generators, and mechanism connected with these magnets automatically cuts out the instruments on the line other than those which are to communicate with each other.

397,194. Multiple Signal Transmitter; Morris Martin, Malden, Mass. Application filed May 31, 1888. The invention is embodied in an instrument comprising a motor and a number of distinct signaling surfaces, such as break wheels or their equivalent, all moved simultaneously by said motor, the two co-operating members of each of the break wheels or automatic circuit-closing and breaking devices being permanently connected in series with one another, and each of the make and break devices being provided with an independent shunt circuit, which, when closed, prevents the corresponding make and break devices from having any material effect upon the circuit.



397,466. PRINTING TELEGRAPH.

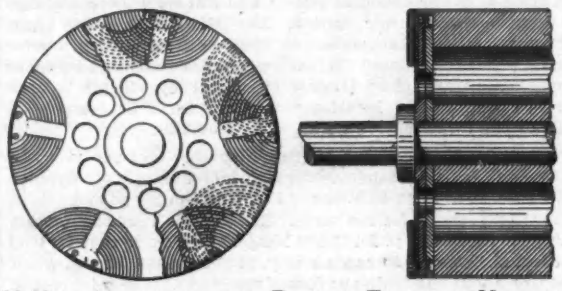
397,218. Insulating Pipe Coupling; S. Bergmann, New York, N. Y. Application filed June 12, 1888. A coupling piece comprising metallic portions provided with communicating gas passages, and insulating material between said metallic portions extending inwardly beyond the walls of the gas passages, said gas passages comprising an enlarged cavity adjacent to the insulating material. By these means the carbonaceous or other material through which a short circuit is effected has a much greater surface to form over than is the case in the old form of coupling piece, whereby a much longer time is required to effect a short circuit, and the life of the coupling piece is materially prolonged.

397,221. Junction Box for Electrical Conductors; W. M. Callender, New York, N. Y. Application filed March 10, 1888. In this system the sheathing of the tubes and the junction boxes themselves are made of indurated fibre or asphaltum. The ends of the tubes are threaded, and the inner surfaces of the junction box at the points of connection with the tubes is correspondingly threaded. The boxes are in two parts, divided longitudinally for the purpose of easily gaining access to the wires within the box. The sections of the box are held together by nuts which screw over the ends of the box at the points where the tubes enter it. By running off the nuts the two halves of the box may be easily pried apart. See illustration.

397,235. Method of Forming Secondary Battery Electrodes; Rudolph M. Hunter, Philadelphia, Pa. Application filed Jan. 27, 1888. The method of forming secondary battery elements consisting in warming the mold, arranging previously formed pieces of active material close together and holding them rigidly in said mold, setting the mold on end, so that the active material pieces are located one above the other, and finally casting the fluid conducting metal around said active material pieces while so held.

397,260. Electric Stop Valve; R. Wellens, Pittsburgh, Pa., Assignor to himself and Joseph Wellens and Hugh Ferguson, all of same place. Application filed April 21, 1888. The object of the invention is to provide a stop valve for the purpose of quickly cutting off steam and stopping the engine from any part of the shop or building without the delay in getting to the throttle, so as to quickly stop the engine in case of accidents. It consists in an oscillating valve whose stem is provided with a weighted arm, which, when released, drops and closes the valve. A catch and electro-magnets operate the same, which electro-magnets are in the circuit of a battery whose wires extend throughout the building and are provided at suitable points with push buttons for closing contact and operating the valve.

397,270. Electric Railway Signal; A. Z. Boda, Columbus, O. Application filed August 22, 1888. Claim: A series of electric railway signal stations arranged upon both sides of a railway and at suitable distances apart, in combination with two independent series of contact points at said stations, a main line wire, a moving train, an audible alarm, conducting arms, and a battery located on said moving train, an electro-magnet in circuit with said battery, an armature lever and contact points in circuit therewith and with said battery, and an armature lever located on said moving train whereby an audible alarm may be sounded thereon.



397,392. ARMATURE FOR DYNAMO-ELECTRIC MACHINES.

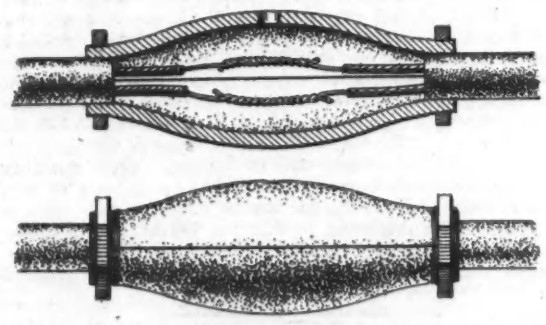
397,284. Telephone Call Box; A. Griffith, of Springfield, and H. A. Burbank, of Wastfield, Mass. Application filed Nov. 6, 1888. This invention is designed to "ring off" automatically. The operation is accomplished when the receiver is placed upon the hook. The invention consists in the special mechanism.

397,300. Electric Wire Conduit; W. B. Mack, Boston, Mass. Application filed Dec. 17, 1888. A conduit composed of pipe sections, vaults or man-holes communicating with the sections, insulating plates secured within the man-holes opposite the ends of the pipes, the plates being perforated for the passage of the wires and separated from the ends of the pipes, and frames within the vaults provided with insulating wire supports.

397,320. Process of Making Dental Plates by Electro-Deposition; J. G. Ward, Irvington, N. J. Application filed April 11, 1887. The process of forming a complete metal dental plate ready for the setting of the teeth, which consists in casting a form from the mouth of the patient, electro-depositing a substantially rigid plate thereon, stripping the plate from the form, and then trimming and adjusting to shape.

397,331. Telephone Circuit and Apparatus; John A. Barrett, Brooklyn, N. Y., Assignor to the American Telephone and Telegraph Co., of New York. Application filed May 9, 1888. The combination with a telephone circuit of a telephone transmitter, an induction coil, whereby the electrical changes produced by the action of the transmitter are propagated through the circuit, and a telephone receiver connected in approximately the middle of the secondary or line helix of the induction coil, the helix being the source of electrical energy for the circuit. See illustration.

397,340. Dynamo; Robert L. Cohen, Camden, N. J., Assignor of one-half to William F. Anderson, Philadelphia, Pa. Application filed Sept. 27, 1888. The object of the invention is to so construct the body of the armature that it may be readily built up and made any desired size and to make its ventilation good. The shell comprises hollow bobbins and interposed spacing pieces.



397,221. JUNCTION BOX FOR ELECTRICAL CONDUCTORS.

397,364. Electric Communicating System; A. G. Holcombe, of New York, N.Y., Assignor to the Equitable Electric Co. of same place. Application filed June 14, 1888. For description see THE ELECTRICAL WORLD, May 21, 1887.

397,392. Armature for Dynamo-Electric Machines; O. B. Shallenberger, Rochester, Assignor to the Westinghouse Electric Company, of Pittsburgh, Pa. Application filed Oct. 11, 1888. In an armature for electric machines, a cylindrical core of soft iron, a set of armature coils wound along the face and down upon the ends of the core, overhanging clips for retaining the coils in position secured to the ends of the armature plates covering the clips and wire upon the ends of the armature, a second set of armature coils wound upon the face of the armature in spaces left vacant by the first set, and down upon the outer surfaces of the respective insulating plates, and winding clips secured to the respective plates for retaining the second set of coils in position. See illustration.

397,418. Protector for Electrical Instruments; Joseph E. Crandall, Washington, D. C. Application filed Nov. 6, 1888. Claim: In a protector for electrical instruments, the combination of a bent bar, one limb of which supports a magnet and the other limb of which supports an armature, contacts arranged on each side of the armature, and a connector between the armature and bar biased so as to tend to hold the armature in equilibrium between the contacts.

397,423. Method of Demagnetizing Watches; John Graves, of St. Louis, Mo. Application filed May 14, 1888. The improved method of demagnetizing articles, consisting in placing the article in the magnetic field and then passing it through the lines of magnetic force to a neutral point.

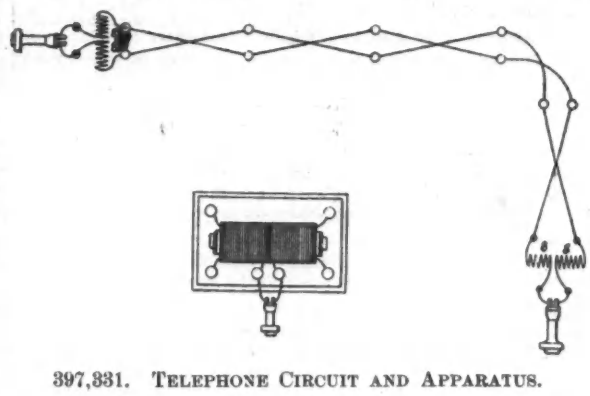
397,424. Connection of Electrical Circuits; W. W. Griscom, of Haverford College, and Henry N. Weidner, of Philadelphia, Pa., Assignors to the Electro-Dynamic Company, of Philhdelphia, Pa. Application filed Aug. 27, 1888. In a connecting device for car or train circuits, two sections of insulating material, each having fixed thereto the terminals of two or more circuits, the terminals on one section registering with the terminals on the other, a hole, and an insulated pin on the meeting surfaces of each section, the pin of one section entering the hole in the other, whereby mistakes in connection are rendered impossible.

387,439. Dynamo-Electric Machine and Motor; Francis J. Patten, New York, N. Y. Application filed July 13, 1888. The object of the invention is to produce an electric motor which may be interposed in a circuit over which passes a continuous current or an alternating current, and yet will be operated in either case, and to produce a machine which, when driven as a generator, may produce either direct or alternating currents. To these ends the invention consists in providing a machine with two external loops in operative relation to the field magnet and armature circuits, and so connected that if a source of direct current be interposed in one loop or a source of alternating current in the other, the motor will be operative; while, on the other hand, if the machine be driven as a generator, direct or alternating currents will flow through the respective loops.

397,443. Secondary Battery; W. A. Shaw, Brooklyn, Assignor to the Electrical Accumulator Co., of New York. Application filed April 14, 1882. The metal or other material forming the conducting base or support is heated to reduce it to a plastic or fluid state, and the active material is stirred therein. The mass is then cast into plates or other suitable forms, or it is cast into an ingot and rolled or otherwise made into shape. The conducting support or base is preferably made of galena (lead sulphide) and lead, and red lead is preferably employed as the active material.

397,451. Overhead Contact and Switch; C. J. Van Depoele, Lynn, Mass. Application filed Nov. 12, 1888. A switch for suspended electric railway conductors, comprising a box attached to the conductor and formed with two or more branching compartments leading therethrough, one or more of the compartments having a contracted portion adjacent to its extremity.

397,461. Electric Converter; L. Gutmann, Fort Wayne, Ind. Application filed May 16, 1886. Patented in England June 24, 1886. An electric converter in which the iron core is made of superposed iron cross-shaped sheets whose arms are bent into two rectangular figures at right angles to each other, and the ends of whose arms all lie in the same or substantially the same plane, and in contact with one another.



397,331. TELEPHONE CIRCUIT AND APPARATUS.

397,466. Printing Telegraph; Andrew T. McCoy, of Boston, Mass., Assignor to John Anderson, of New York, N. Y. Application filed Oct. 17, 1887. In an electric printing machine, three type wheels having the same axis, one of the wheels provided with type required for printing on either of two parallel lines, and each of the other wheels provided with type required to print on one only of said lines. See illustration.

397,474. Therapeutical Electrode; L. T. Stanley, Brooklyn, N. Y., Assignor to the Stanley Electric Company, of Philadelphia, Pa. Application filed Sept. 14, 1887. An electrode composed of a row or line of long flexible metallic teeth with blunt or rounded ends secured to a backing or base, and provided with circuit connections.

397,479. Incandescent Lamp Manufacture; James A. Vandegrift, Newark, N. J. Application filed Nov. 10, 1888. The improvement in the art of making incandescent lamps, which consists in introducing into a glass globe the glass base or stem surrounding the leading-in conductors on which the carbon is mounted, then closing the globe or neck, and then perforating the same for the passage of the leading-in conductors and fusing or sealing in the glass base or stem.

PATENTS EXPIRED FEBRUARY 18, 1889.

123,711. Electrical Circuits for the Chemical Telegraph; Geo. Little, Rutherford Park, N. J. Patented Feb. 13, 1872. An adjustable rheostat is applied in a circuit between the main line and the earth. This regulates the proportion of current passing to the receiving instrument.

123,600. Lightning Rod; W. A. Wells, of St. Paul, Minn., and G. House, of Gallipolis, Ohio. Patented Feb. 13, 1872. A lightning rod consisting of a continuous piece of iron made flat upon its rear side and fluted upon its front side. It has a sheet copper covering.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Potter Building, N. Y.